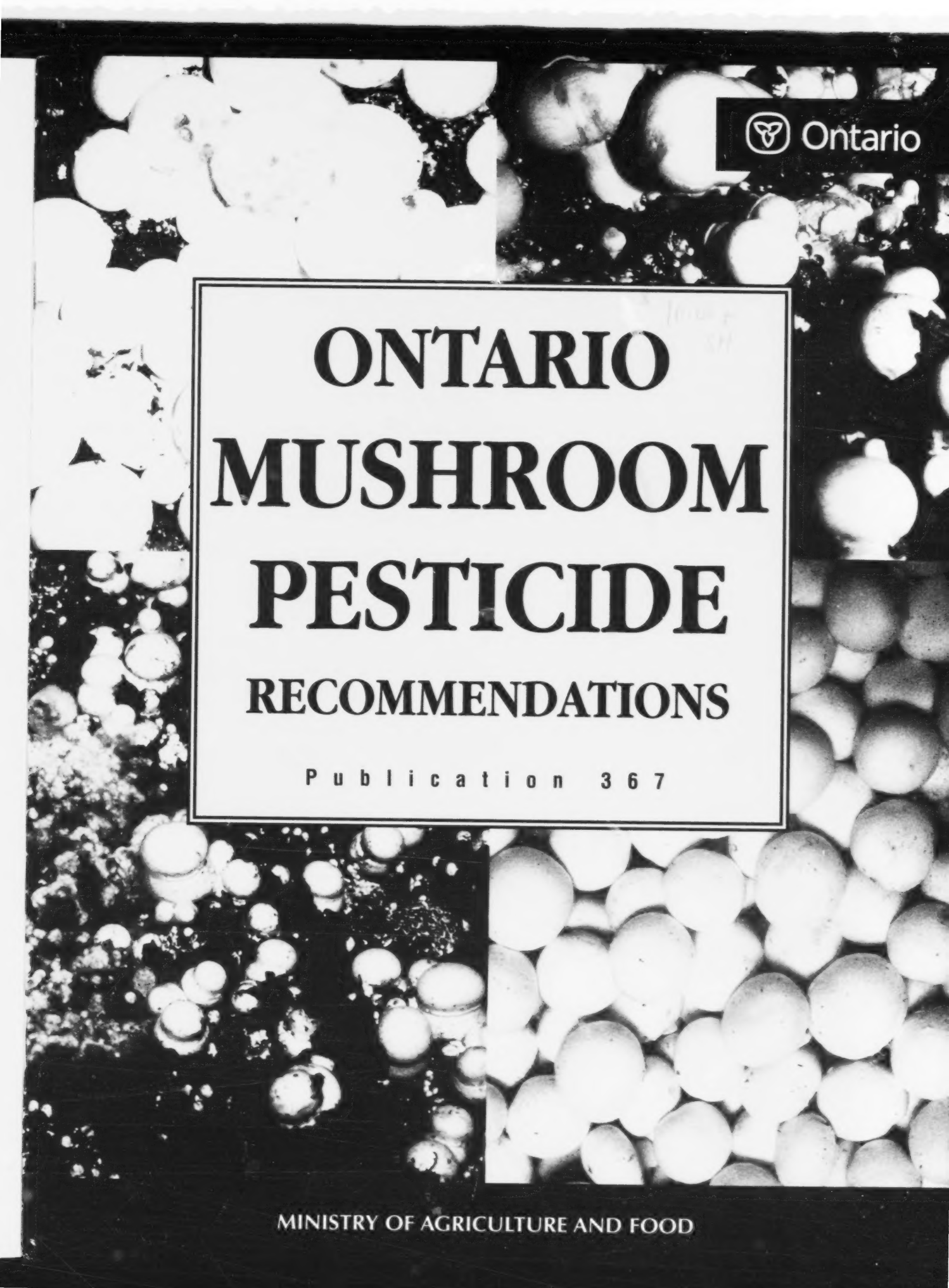

Ontario

ONTARIO MUSHROOM PESTICIDE RECOMMENDATIONS

Publication 367

MINISTRY OF AGRICULTURE AND FOOD

Recycle old editions of this publication. Each year the appropriate working group of the Ontario Pest Management Research and Services Committee reviews the pesticides listed in this publication. To the best knowledge of the committee, at the time of printing, all of these pesticides were:

- federally registered
- reviewed by the Ontario Pesticides Advisory Committee (OPAC)
- classified by the Ministry of the Environment as of November 2002.

The information in this publication is general information only. By printing this publication, the Ministry of Agriculture and Food does not offer any warranty or guarantee, nor does it assume any liability for any crop loss, animal loss, health, safety or environmental hazard caused by the use of a pesticide mentioned in this publication.

The pesticide product label is a legal document. It is against the law to use the product in any other way. You must also use all pesticides in accordance with the *Pesticides Act* and Regulation 914, administered by the Ontario Ministry of the Environment.

In this publication, most recommendations list several pesticides that can be used for each pest discussed. In general the least hazardous materials and those pesticides that pesticide applicators have used satisfactorily for years are listed first. More toxic pesticides and/or newer ones with less practical grower experience follow.

This publication lists a number of brand names of pesticides. This is for your convenience only. It is neither an endorsement of the product nor a suggestion that similar products are ineffective.

Consult each product label for specific information such as compatibility with other materials and the effect of environmental conditions. Weather and other factors influence the effectiveness of pesticides and the likelihood of crop injury.

Health Canada has established maximum residue limits (MRLs) for pesticides. Processors or retailers may demand more restrictive limits. Growers should seek advice of their intended market as to which restrictions or limitations apply. Keep accurate and up-to-date records on pesticide use in each crop.

Federal Registration of Pesticide Products

The Pest Management Regulatory Agency (PMRA) of Health Canada grants registration following an evaluation of scientific data to ensure that the product has merit and value; and the human health and environmental risks associated with its proposed use are acceptable.

1. **Full Registration**
   Pesticide registrations are normally granted for a period of five years, subject to renewal.
2. **Temporary Registration**
   Temporary registration may be granted for a period not to exceed one year, where the registrant agrees to produce additional scientific or technical information, or the pesticide is used for emergency control of a serious pest outbreak.

Supplemental Labels

You MUST obtain a supplemental label and follow all the label directions when PMRA approves new uses for a registered pesticide that do not appear on the current label.

Examples of when you must use a supplemental label include:

- **Temporary Registrations for Emergency Use**
- **Minor Use Label Expansion** (new label statements for crops that do not already appear on that product label).

You can obtain a copy of a supplemental label from the pesticide manufacturer or pesticide vendor, the grower association that sponsored the emergency registration or minor use, from OMAF or PMRA's Pest Management Information Service.

For more information on the federal registration status check the PMRA Web site at *www.hc-sc.gc.ca/pmra-arla* or call **1-800-267-6315.**

Regulation of Pesticides in Ontario

Classification of Pesticides into "Schedules"

The Ministry of the Environment classifies all pesticide products into one of six schedules, based on the potential hazards that product may have for human health and the environment. For up-to-date information on the regulatory status of any pesticide check the Ontario Pesticides Advisory Committee Web site at *www.opac.gov.on.ca* or call (416) 314-9230/ fax (416) 314-9237.

Licensing and Certification Requirements for Pesticide Users

You must be a certified grower or licensed exterminator to buy and use Schedule 1, 2 and 5 pesticides.

Requirements for Growers and their Assistants

Growers must be certified through the **Grower Pesticide Safety Course** to buy and use Schedules 1, 2 or 5 pesticides on land they farm. There must be at least one certified grower for each farm operation.

All agricultural assistants must also receive formal pesticide safety training, recognized by the Ministry of the Environment, before they can use Schedule 2 or 5 pesticides under the supervision of a certified grower. This applies to all assistants — including family members, farm employees and seasonal workers.

For more information about training for growers and agricultural assistants check the Ontario Pesticide Education Program Web site at *www.ridgetownc.uoguelph.ca/opep/* or call 1-800-652-8573.

Requirements for Commercial Applicators and their Assistants

If you plan to apply pesticides as a business, you must be a licensed exterminator. **This includes farmers who custom apply pesticides for other farmers and charge a fee for this service.** You must complete a home study course and certification exam, and send proof of certification to the Ministry of Environment to obtain your license.

Unlicensed assistants must be Technicians before they may handle Schedule 2 (with restrictions), 3, 4 and 6 products under indirect supervision of a licensed exterminator. Technicians may not handle Schedule 1 and 5 products. For more information about exterminators and technicians check the Ontario Pesticide Training and Certification Web site at *www.ridgetownc.uoguelph.ca/optc* or call 1-888-620-9999.

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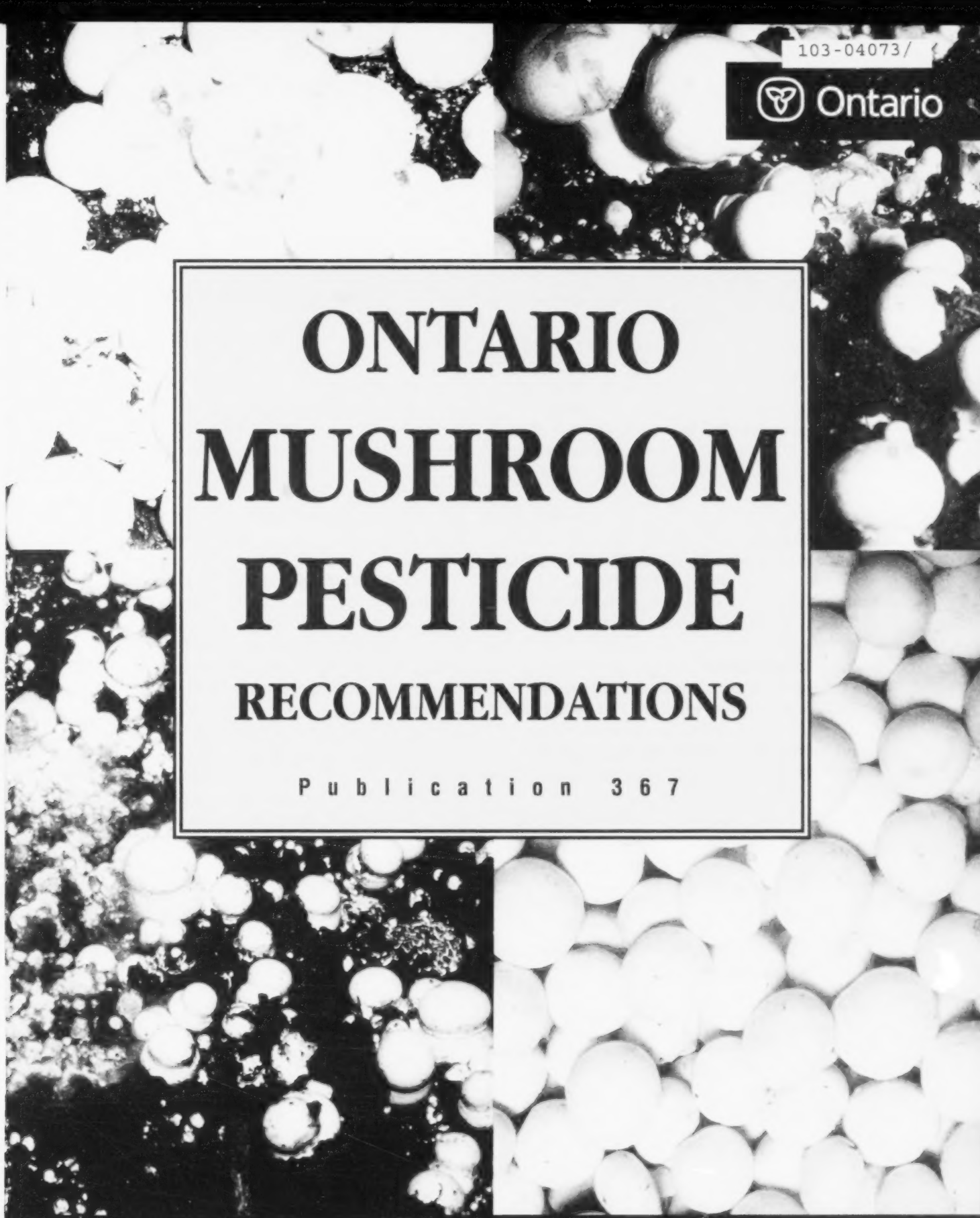
Ontario

ONTARIO MUSHROOM PESTICIDE RECOMMENDATIONS

Publication 367



MINISTRY OF AGRICULTURE AND FOOD

Publication 367
Ontario Mushroom Pesticide Recommendations

Editor
Dr. Danny Lee Rinker, Associate Professor, Mushroom Specialist, University of Guelph

Acknowledgements
The recommendations contained in this publication have been prepared by personnel of the Ontario Ministry of Agriculture and Food and the University of Guelph.

Need technical or business information?
Contact the Agricultural Information Contact Centre at
1-877-424-1300
or
ag.info@omaf.gov.on.ca

For information or to obtain copies of this or any other ministry publication, please call 1-888-466-2372 from within Ontario, (519) 826-3700 from outside the province or OMAF's TTY line at (519) 826-7402 for the hearing impaired, email your request to products@omaf.gov.on.ca, or visit OMAF's Web site at www.gov.on.ca/omaf.

A complete listing of all OMAF products and services and order forms are available on the Web site. Orders can be faxed to (519) 826-3633 or mailed to Government Information Centre, OMAF, 1 Stone Road West, Guelph, ON N1G 4Y2

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1. Precautions with Pesticides

Pesticide Regulations

You must report all major spills, fires or thefts involving pesticides to the Ontario Ministry of the Environment at 1-800-268-6060. (Regulation 914, s. 29)

Pesticide Schedules in Ontario

The Ontario Ministry of the Environment reviews each pesticide product offered for sale in Ontario and classifies it into 1 of 6 groupings called Schedules.

Schedule	Who can use it	Pesticide characteristics*
1	• licensed exterminator • certified grower • only with approved permit	• very toxic • very persistent • highly mobile
2	• licensed exterminator • certified grower • trainee or technician under supervision of a licensed applicator (some restrictions apply) • assistant agriculturist under supervision of a certified grower	• toxic • persistent • moderately mobile
3	• licensed exterminator • certified grower • trainee or technician • consumer	• moderately toxic • moderately persistent • slightly mobile
4	• licensed exterminator • certified grower • trainee or technician • consumer	• low toxicity • non-persistent • non-mobile • containers < 1 kg or < 1 L
5	• licensed exterminator • certified grower • assistant agriculturist under supervision of a certified grower	• very toxic • very persistent • highly mobile • less toxic or less persistent alternative not available
6	• any person	• low toxicity • non-persistent • non-mobile • containers > 1 kg or > 1 L

* Biological persistence and mobility in the environment, as expected under normal use conditions in Ontario.

Certification and Training Requirements

You must be a certified grower or a licensed exterminator to buy and use Schedule 1, 2 and 5 pesticides.

Pesticide Certification for Ontario Farmers

Regulation 914 of the *Pesticides Act* requires agriculturists (growers) to be certified to buy and use Schedules 1, 2 or 5 pesticides on land they farm. To become certified, agriculturists must:

- attend the Grower Pesticide Safety Course (GPSC) and successfully complete the examination, and
- meet the definition of a certified "agriculturist" as defined by Regulation 914 under the *Pesticides Act* (i.e. use farm land for agricultural or forestry production, and that land falls within the farmlands property class under Section 7 of the *Ontario Assessment Act*), and
- be at least 16 years old.

Training for Agricultural Assistants Using Schedule 2 or 5 Pesticides

All assistants must have formal pesticide safety training that is recognized by the Ministry of the Environment before they can handle or use Schedule 2 or 5 pesticides under the supervision of a certified grower.

- This applies to all assistants, including family members, farm employees and seasonal workers.
- Trained assistants do not have to write an exam.
- Trained assistants must be 16 or older.
- There are 2 training options for assistants. Assistants can:
- attend a Grower Pesticide Safety Course (GPSC) (an examination is not required), or

- attend an on-farm training session presented by a qualified trained assistant instructor.

For more information and a listing of grower pesticide safety courses and locations, check the Ontario Pesticide Education Program Web site at www.ridgetownc.uoguelph.ca/opep/.

To register for a grower pesticide safety course (GPSC) anywhere in Ontario, or for information about trained assistants please:
- call 1-800-652-8573
- fax 1-519-674-1589
- e-mail opep@ridgetownc.uoguelph.ca.

Certification and Licensing for Commercial Exterminators

You must be a licensed exterminator if you plan to apply pesticides as a business. This includes farmers who custom-apply pesticides for other farmers and charge a fee for this service. Licensed exterminators who are self-employed must hold an operator licence as well as the appropriate exterminator licence. Exterminator licenses are valid for 5 years.

To become a licensed exterminator, you must:

- complete a home study course and certification exam through Ridgetown College, University of Guelph, and

- send proof of certification (letter of successful completion of the exam(s)) and a fee to the Ministry of the Environment to obtain your exterminator licence. (See *APPENDIX B. Ontario Ministry of Environment Pesticides Control Offices Pesticide Officers* on page 30.)

Training for Technicians Working as Assistants to Licensed Exterminators

Assistants to licensed exterminators must become Technicians to mix, load or apply all Schedule 3, 4 and 6 pesticides and most Schedule 2 pesticides (some restrictions apply), under the indirect supervision of a licensed exterminator. Technicians cannot mix, load or apply Schedule 1 or 5 pesticides. Technician cards are valid for 2 years. To become a technician, you must:

- complete an MOE-approved academic course and exam and
- complete practical training with a licensed exterminator.

For more information about certification and licensing requirements for licensed exterminators and training for technicians, contact Ontario Pesticide Training & Certification:
- call 1-888-623-9999
- fax to 519-674-1585
- check the Web site at www.ridgetownc.uoguelph.ca/optc.

General Precautions

Always read the label:

- Before you buy a pesticide!
- Before you begin to use a pesticide!
- Before you store a pesticide or dispose of it!

Learn about the health hazards and toxic properties of the pesticide you are using. Consult the product label, Material Safety Data Sheets (MSDS), or manufacturer for this information. Check the company Web sites for MSDS information.

Protect Yourself When You Use Pesticides

- **Make sure someone knows** where you are working, what pesticides you are handling and how long you expect the job to take.

- **Post emergency numbers**, including the Poison Information Centre and Spills Action Centre, near all telephones.

- **Keep a list of the names and the Pest Control Products (PCP) Act Registration Numbers of all pesticides you handle**. Keep a file of the pesticide label booklets for all products you use. Make sure your co-workers and family members know where this list or file is in case of an accident. The list of chemicals used for mushrooms is in *Table 1-3. Pesticides listed in this publication* on page 13.

- **Have plenty of clean water, soap and paper towels, and an extra set of gloves and coveralls nearby at all times** in case a pesticide contaminates your clothing or skin.

- **Wear the correct protective clothing and equipment, and be sure all items are clean and in good repair, before you put them on.**
- **Never smoke, chew tobacco, eat or drink when you handle pesticides.** Never carry tobacco or food in your clothes, and never leave tobacco, food or beverages in areas where you handle or store pesticides.
- **Change your clothes and wash your hands and face before you eat, drink or smoke.**
- **Wash your hands before you use the toilet,** as well as after. The skin in your groin area absorbs pesticides very easily.
- **Pregnant women should not handle or use pesticides.**

Protect Other People, Livestock, Pets, Water and Sensitive Crops

- Buy and store only what you need.
- Prevent drift.
- Keep pesticides out of water.
- Clean up spills quickly and safely.
- Dispose of containers and waste pesticide safely.

Read and Follow Pesticide Label Information

Know the Hazard Symbols and Words

Learn these symbols and words — they could save your life!

Check the label for special warnings about eye hazards and skin hazards.

The front panel of the pesticide label may also contain warnings that tell you the product is corrosive to eyes, or is a skin or eye irritant.

Four important symbols and words show the potential hazards of pesticides.

Hazard symbol	Signal word
	Poison
	Corrosive
	Flammable
	Explosive

The hazard symbol always appears inside one of the shapes shown below. These shapes and their warning words tell you the degree of hazard of the pesticide. **The greater the number of sides to the shape, the more hazardous the product.**

	Warning symbol	Signal word
Triangular shape means 'ow hazard (3 sides)		**Caution**
Diamond shape means moderate hazard (4 sides)		**Warning**
Octagonal shape means high hazard (8 sides)		**Danger**

Re-Entry Periods

Re-entry period is the minimum amount of time that must pass between the time the pesticide was applied and the time that workers can go into the crop area without wearing personal protective equipment. If workers enter fields without wearing protective equipment too soon after pesticides have been applied they may experience poisoning. Such poisoning can result from handling treated plants or from inhaling pesticide vapours.

Days to Harvest (Preharvest) Intervals, Pregrazing and Feeding Intervals

These intervals state the minimum amount of time that must pass between the last pesticide application and the harvesting of the crop, or the grazing or cutting of the crop for livestock feed. If you harvest a crop before the preharvest interval has passed, there may be pesticide residues in excess of the Maximum Residue Limits (MRL) set by Health Canada. When crops with persistent residues are fed to livestock, the pesticides may poison the animal or may contaminate the milk or meat.

To avoid exceeding the Maximum Residue Limits, always follow the label.

Total Number of Applications

Some product labels state the total number of applications of that pesticide that can be made during a growing season. These limits prevent food residues, crop damage, soil residues or pest resistance.

Human Health

Risks of Pesticide Use

Each time you handle a pesticide, you are at some risk. The amount of risk depends on 2 things: the toxicity of that pesticide and your exposure to it.

Risk = Toxicity X Exposure

Toxicity is a measure of how harmful or poisonous the pesticide is. There are 2 types of toxicity:

- **Acute toxicity** — the toxic response that results from a single exposure to the pesticide. The symbols and words on the front panel of a pesticide label give you information about the acute toxicity.
- **Lethal Dose 50% (LD_{50})** is a measure of acute toxicity. It is the dose (mg of product per kg of body weight) that will kill 50% of the test animals within a stated period of time (24 hr, 7 days).

Examples of products listed in this publication with a high acute toxicity are listed in *Table 1-1. Relative Acute Toxicity of Pesticides*.

Table 1-1. Relative Acute Toxicity of Pesticides

High acute toxicity	
dichlorvos	Ditching DDVP Vapona Industrial Fogging Insecticide
Moderate acute toxicity	
diazinon	Clean Crop Diazinon 500, Clean Crop Diazinon 500E, Clean Crop Diazinon 50W, Diazol 50 W Insecticide Wettable Powder, Diazol 50EC Emulsifiable Concentrate Insecticide, Ditching Diazinon 50E, Plant Products Diazinon 500EC, Wilson Diazinon 50EC
dimethoate	Chemironva Cygon 480 Systemic Insecticide, Chemironva Cygon 480 AG Systemic Insecticide, Clean Crop Lagon 480E Insecticide, IPCO Cygon 4 E, Dimethoate Plus Emulsifiable Liquid Insecticide
formaldehyde	Clean Crop Formalin Fungicide Solution
permethrin	Ambush, Pounce
pyrethrin	Clean Crop Mushroom Fly Dust, Wilson P-100 Mushroom House Insecticide

- **Chronic toxicity** — the toxic response that results from repeated exposures to small doses of a pesticide over a longer period of time. These toxic effects may not appear for months or years after exposure to the pesticide. The symbols on the label do NOT give information about the chronic toxicity of the product. Use protective clothing and equipment to help reduce exposure and the risk of chronic effects.

Cholinesterase Blood Tests

Organophosphorus and *carbamate* pesticides can affect your nervous system. These pesticides can change your serum and red blood cell levels of an enzyme called acetyl cholinesterase. Your body uses this enzyme to transmit messages through your nervous system. If your cholinesterase levels fall, you can experience symptoms including trembling, twitching, blurred vision, difficulty breathing and heart difficulties.

If you use any of these pesticides routinely have your cholinesterase blood tested regularly (see *Table 1-2. Pesticides that affect cholinesterase levels in blood* on page 5). Your family doctor can arrange these tests, which are covered by OHIP. **Have your first test before you begin to handle these pesticides.** That shows the baseline (normal) cholinest-

ensive level for your body. During the spray season, if you are spraying organophosphorus or carbamate insecticides regularly for several weeks, have a cholinesterase blood test every **7–10 days**. If your cholinesterase level drops to below one-half of your baseline level, then you are showing signs of pesticide poisoning and **you must remove yourself from exposure** to these pesticides until your cholinesterase level returns to normal.

Table 1-2. Pesticides that affect cholinesterase levels in blood

diazinon	Clean Crop Diazinon 50W, Clean Crop Diazinon 50XE, Clean Crop Diazinon 50W, Diazol 50 W Insecticide Wettable Powder, Diazol 50EC Emulsifiable Concentrate Insecticide, Ditching Diazinon 50E, Plant Products Diazinon 500EC, Wilson Diazinon 50EC
dichlorvos	Ditching DDVP Vapona Industrial Fogging Insecticide
dimethoate	Chemnova Cygon 480 Systemic Insecticide, Chemnova Cygon 480 AG Systemic Insecticide, Clean Crop Lagon 480E Insecticide, IPCO Cygon 4-E Dimethoate Plus
malathion	Clean Crop Malathion 85E, Clean Crop Mushroom Fly Dust, Clean Crop Malathion 50XE, Clean Crop Malathion 25W, Diapar Malathion 50, Fyfanon 50% Emulsifiable Concentrate Insecticide, Fyfanon 25% WP, Wilson Malathion 50EC

Exposure is a measure of the contact you have with a pesticide. You can be exposed to a pesticide in 3 ways.

- **Dermal exposure** occurs through your skin or eyes. The amount and rate of pesticide that may be absorbed depends on several things, including
  - your skin condition. If your skin is moist, or if you have a rash, broken skin or scratches, a pesticide will be absorbed more easily.
  - the part of your body that is exposed. Your eyes, genital area, scalp and ear canals absorb pesticides at a higher rate than your hands or arms. Your eyes absorb pesticides at a rate of 100%.
- **Respiratory exposure** (inhalation) occurs when you inhale small spray particles, dust, gases or vapours.
- **Oral exposure** occurs when a pesticide enters your mouth or you swallow a pesticide.

First Aid

1. Always protect yourself from injury first. Don't become another victim. Always put on protective clothing and equipment before you enter a contaminated area or handle a contaminated victim.

2. Check to see if the victim is breathing.

   If the victim is not breathing:
   - Straighten the victim's airway and check for breaths.
   - If the victim does not begin to breathe, administer artificial respiration until the victim begins to breathe on their own.
   - Do not contaminate yourself, especially if the victim has pesticide or vomit around his face or mouth. Use a face shield airway with a one way valve. Do not breathe the exhaled air from the victim.
   - Perform CPR if the victim's pulse disappears. Only perform CPR if you are trained to do so.

   If the victim is breathing, but unconscious:
   - Place the victim in the recovery position (on the side with the head turned slightly to one side). If the victim vomits, try to keep the airway clear.

3. Stop the exposure to the pesticide. Move the victim away from the contaminated area. Remove all contaminated clothing. Use soap and water to wash any skin exposed to the pesticide.

4. Check the Four Basic Facts:
   - **Identify the pesticide.** Look for the label, container or leftover pesticide.
   - **Quantity.** How much product was the victim exposed to?
   - **Route of entry.** How did the pesticide enter the body? Did it enter through the mouth, skin, eyes or lungs?
   - **Time period.** How much time has passed since the victim was exposed to the pesticide, and how long was the exposure? Were the symptoms immediate or did the poisoning occur as a result of using the pesticide over a longer period of time?

Don't waste time. If you can't answer these questions quickly, be ready to tell emergency personnel whatever you can.

5. Call an ambulance or the Poison Information Centre.

6. Start the first aid treatment appropriate for the route of entry.

7. Make sure the patient gets medical attention. First aid is not a substitute for professional medical help.

If symptoms of illness occur during or shortly after handling a pesticide, go to a hospital. Take the pesticide label, Material Safety Data Sheet (MSDS), or pesticide container with you. Do not transport the container in the passenger compartment of the vehicle.

Refer to the Emergency Procedures for Pesticide Poisoning on the inside back cover.

Protective Clothing and Equipment

Choose and Wear the Appropriate Protective Clothing and Equipment

Make sure your protective clothing and equipment:

- is what you need for the job
- fits properly, and
- is clean and in good repair and working condition.

The protective clothing and equipment you need to wear depends on:

- **the pesticide you are using**. READ THE PRECAUTIONS SECTION OF THE LABEL TO KNOW WHAT TO WEAR

- **the job you are doing**. For example, you need more protection when you handle concentrated pesticide, or when you mix and load your sprayer.

- **the type of application**. Enclosed space or air blast sprayer applications made with open tractors require more equipment.

Each person who is working with pesticides needs **their own** set of protective clothing and equipment. Consult the technical expert at your safety supply company to make sure that you purchase the appropriate equipment and that it fits the user.

For ALL pesticides, always wear:

- a water-repellent hat such as a hard hat or waterproof rain hat. Sometimes you need to protect your entire head and neck. For example, if you apply pesticides in a greenhouse, apply dusty formulations or use an air-blast sprayer. In these types of situations, wear a hood or hat that protects your ears and ear canals. Do not wear hats made from cloth. Baseball-style caps absorb pesticides and are not safe.

- long pants and a shirt with long sleeves, or a coverall. Coveralls can be reusable or disposable. Reusable coveralls are normally cotton or polyester and should be tightly woven. Cotton, denim and cotton-polyester fabrics can absorb pesticides and transfer pesticides to your skin. If you spill pesticide on your clothing, remove the clothing immediately.

- chemical resistant gloves (unlined). Use neoprene or nitrile gloves, unless the label states otherwise. Do not wear rubber gloves as many pesticides can break down the rubber material. Wear your gloves under your sleeves with the top cuffed.

- chemical resistant boots (unlined). Wear pant legs outside the boots to stop pesticides from getting into the boot. Do not wear canvas or leather. These materials absorb pesticides.

Read the label. It describes what extra protective clothing and equipment to wear. For some pesticides you may also need to wear:

- goggles. Use safety goggles with indirect vents so that splashes do not enter eyes. Regular eyeglasses don't provide complete protection. Never wear contact lenses when you handle pesticides.

- face shield
- chemical resistant apron
- respirator. A respirator is a unit that covers your mouth and nose to prevent spray droplets, small particles, and vapours from getting into your lungs. **A dust mask is not a substitute for a pesticide respirator.** When you buy a respirator or replacement cartridges, make sure the cartridges and prefilters protect you against organic vapours. For more information about respirators, refer to the *Grower Pesticide Safety Course Manual*, Ridgetown College, University of Guelph.

You may need more protection, such as **Canister Gas Masks or Self-Contained Breathing Apparatus (SCBA)** when you apply:

- any pesticide in an enclosed area, or
- fumigants, gases, vapours or smokes.

ALWAYS wear a respirator when you work with fumigants, gases or vapours, or when you apply any pesticide in an enclosed area.

Safety Supply Companies

Consult the safety supply company(s) of your choice for help in selecting your protective clothing and equipment. (See Table 1-3.)

Table 1-3. Safety supply companies in Ontario providing protective clothing and equipment

3-M Canada Inc.	Occupational Health and Environmental Safety, Box 5757 London, ON N6A 4T1	(519) 452-6165 1-800-364-3577 Fax: (519) 452-4660
Acklands Grainger	90 W. Beaver Creek Rd. Richmond Hill, ON L4B 1E7	(905) 731-5516 1-800-668-8989 Fax: (905) 731-2798
Aearo Canada	7115 Tomken Rd. Mississauga, ON L5S 1X7	(905) 795-0700 1-800-387-4304 Fax: (905) 564-5250
Dutch Industries "Protect-Air Cab Filter"	Huron Tractor, Box 1300 Exeter, ON N0M 1S3	(519) 235-1115 Fax: (519) 255-1939
HAMISCO	3392 Wonderland Rd. London, ON N6L 1A8	(519) 652-9800 1-800-668-9800 Fax:(519) 652-9661
Kappler Canada	Box 1687 20 Ryan Place Brantford, ON N3T 5V7	(519) 752-4369 1-800-387-9326 Fax: (519) 752-2161
Levitt-Safety (Eastern) Limited	2872 Bristol Circle Oakville, ON L6H 5T5	(905) 829-3299 1-800-668-6153 Fax: (905) 829-2919
MSA Canada Inc.	148 Norfinch Dr. North York, ON M3N 1X8	(416) 667-9400 1-800-267-0672 Fax: (416) 663-5908
Mitt & Robe Co.	751 Norfolk St. N. Simcoe, ON N3Y 3R6	(519) 428-4050 1-877-893-6565 Fax: (519) 428-5142
Plant Products Co. Ltd.	314 Orenda Road Brampton, ON L6T 1G1	(905) 793-7000 1-800-387-2449 Fax: (905) 793-9632
Safety Express	4060B Sladeview Cres., Unit 2 Mississauga, ON L5L 5Y5	(905) 608-0111 1-800-465-3898 Fax: (905) 608-0091
The Saint George Company (Suppliers of Kasco Helmets)	P.O. Box 430 20 Consolidated Drive Paris, ON N3L 3T5	(519) 442-2046 1-800-461-4299 Fax: (519) 442-7191

Care of Protective Clothing and Equipment

- After you complete the spray operation, clean all protective clothing and equipment.
- Never let children, pets or livestock come in contact with contaminated clothing or equipment. Make sure they do not come into contact with the puddles of water that result from cleaning your equipment.
- Wash your gloves with soap and water, then *leave them on* to remove your other protective clothing and equipment.
- Always remove protective clothing and equipment outdoors. If a granular pesticide was used, shake the clothing outdoors in a safe place, emptying pockets and cuffs.
- Throw out clothing contaminated by spills of highly toxic or concentrated pesticide. Place clothing in a plastic bag and take it to a landfill site.
- **Coveralls and other spray clothing must be washed separately from other clothes.** Wash after each use. Place them in a plastic bag and keep them separate.
- With your hands still protected by gloves, wash protective equipment. It is best to wash equipment outdoors. If you do not have an outside clean-up area, keep certain buckets just for equipment clean up. Mark them and keep them in a special place. Wash the inside and outside of your goggles, hat, boots, and any water-repellent clothing in warm soapy water, rinse well and let them air-dry.
- Remove the cartridges and prefilters from the respirator.
- Discard cartridges, canisters and filter pads when breathing becomes difficult, when you notice a pesticide taste or odour, or at the interval set by the manufacturer.
  - Note the date the cartridge is first used.
  - Remove cartridges and filter pads from the face piece and store in clean, sealed plastic bags.
  - Wash the face piece in warm soapy water, rinse thoroughly, and dry in a well-ventilated area. Air-drying prevents damage to the inlet and outlet valves.
  - Never use alcohol or other solvents for cleaning, as they damage the rubber and plastic.
- Next wash the outside of your boots and gloves with soapy water and remove them.
- After removing boots and gloves, wash them inside and out with detergent and water, rinse thoroughly, and dry in a well-ventilated area.
- Place all dry articles in a clean storage area until next use.

How to Wash Your Spraying Clothes

Never mix spray clothing with household laundry. All clothing used for spraying must be stored and washed separately from other clothing. Wash after each use. Remember to use chemical resistant gloves to handle pesticide-contaminated clothing.

- Presoak clothing before washing. Use 1 of 3 methods:
  - hose-off garments outdoors
  - soak in separate tub or pail
  - use the prewash cycle in automatic washer.
- Place clothing directly into the washing machine. Wash only a few garments at a time. Do not wash with other family clothes.
- Use hot water, the highest water level, and the longest cycle, with heavy duty detergent. Wash as you would for heavily soiled clothing.
- Wash clothing again.
- After washing, hang outside (preferably in bright sunlight) until completely dry. Do not use the clothes dryer.
- Clean the washing machine. Run the washing machine through one complete cycle using only detergent and hot water. (No clothing.)

Personal Hygiene

- Always wash your hands and face before you eat, drink or smoke.
- **When you are finished for the day, take a bath or shower as soon as possible**. The longer a pesticide remains on your skin, the greater the risk it will be absorbed into your body.

- Wash your hair and under your fingernails. Shower with lots of soap and water.
- Always change into clean clothes.
- Wear clean work clothes every day. A small spill on the previous day's clothes may seem unimportant, but wearing the same clothing again without washing it prolongs the exposure and increases your risk.

Protect the Environment

Protect Water Sources

- You must use an anti-backflow device to prevent back siphoning when drawing water from wells, ponds, streams or other sources.
- Mix pesticide and load the sprayer away from any water supply, including wells, ponds or streams.
- Use buffer zones (untreated areas) when you apply pesticides to avoid contaminating surface water, wells, ponds or streams. Check the product label for specific buffer zone distances.

Reduce and Manage Pesticide Spray Drift

Spray only when winds are light to moderate. If you notice drift is occurring because of the wind, **stop spraying** until the wind subsides. Do not apply pesticides if the wind is blowing towards susceptible crops or environmentally sensitive areas such as watercourses.

- Read the product label for information regarding buffer zones, water volumes and recommended nozzles.
- Use buffer zones around all watercourses, wells and neighbouring fields that contain sensitive crops. If the label does not state a specific buffer zone distance, leave an untreated area of natural vegetation.
- Select the recommended sprayer application rate (L/ha).
- Select the correct nozzle. Where practical, use air induction/venturi nozzles. These nozzles significantly reduce drift when compared to conventional nozzles.
- Select the correct nozzle-to-target distance.
- Use spray plume protection where practical or available (hoods, shrouds, screens and air curtains).
- Use drift-reducing adjuvants in the spray tank as directed by the label.
- Use wick weeders instead of spraying, when possible.

For more information about spray drift consult OMAF Factsheet, *Reducing Pesticide Drift and Crop Damage*, Order No. 00-103, OMAF/ Agriculture and Agri-Food Canada booklet *Best Management Practices Pesticide Storage, Handling and Application* and the Ontario Pesticide Education Program (Ridgetown College) videos *How to Manage Spray Drift* and *Spray Drift Reduction through Air Induction.*

Disposal of Pesticides and Empty Pesticide Containers

Triple or Jet Rinse Your Empty Pesticide Containers

Unrinsed pesticide containers are not really "empty". They may still hold about 1% of the original amount of pesticide. Although this figure sounds low, it is still a hazard to humans, animals, and the environment. To reduce the hazard, rinse each container 3 times as the spray tank is filling. Use either the manual triple-rinse technique, or a specially designed device for rinsing containers. Paper or cardboard containers are often strong enough to be rinsed. If it is possible, rinse these containers as well as plastic ones.

To Triple Rinse

1. Fill the empty container at least 10% full of the diluting material (usually water).
2. Cap, then shake or roll the container so that the inside surfaces of the container are well rinsed.
3. Pour rinsings into the spray tank.
4. Repeat steps 1–3 twice more.

Remember to check the container after you have finished rinsing. Make sure no pesticide has been left behind as a cake or paste on the bottom of the container.

Rinsing Devices
Rinsing devices use pressurized water to clean the container. They are just as effective as triple rinsing but take less time. Follow the manufacturer's instructions.

How to Dispose of Empty, Triple-Rinsed Containers

Never reuse empty pesticide containers. They may be handy, but there is still some risk, even if the containers are triple rinsed. Never give empty, rinsed containers to anyone, especially not children. Dispose of them promptly.

Regulation 914 of the *Pesticides Act* regulates how pesticide containers are to be disposed of in Ontario.

For Metal, Plastic, or Glass Containers
Dispose of an empty metal, plastic, or glass container that has been used to hold a Schedule 1, 2, 3*, 5 or 6* (*non-domestic) pesticide by triple rinsing or jet rinsing using clean water, or another appropriate solvent

AND either

- taking it for recycling to a pesticide container depot

OR

- taking it to a licensed waste disposal site. (Reg. 914, s. 27)

Once properly rinsed, puncture the containers so they cannot be reused and to make sure the rinse water is totally out of the container.

It is often more convenient to store empty, rinsed containers until you have collected enough to make a trip to the recycling pesticide container depot or the waste disposal site. If you store containers, keep them in a dry safe place, such as the storage area, until you can dispose of them properly.

Recycling
The Ontario Pesticide Container Recycling Program is available to growers and commercial exterminators. Through this program, **clean, triple rinsed, plastic/metal pesticide containers** (up to 23 L in size for plastic and 20 L in size for metal) can be returned to pesticide container depots located throughout the province. To locate the pesticide container recycling depot closest to you, call the Ontario Pesticide Education Program at 1-800-652-8573.

Future Farm Supply in Aylmer has a recycling pesticide container depot to collect empty metal drums that contained sucker oil and fumigants used in tobacco and fruit production.

For Paper and Cardboard Containers
Dispose of a paper or cardboard container that has been used to hold a Schedule 1, 2, 3*, 5 or 6* (*non-domestic) pesticide by triple rinsing or jet rinsing (if possible) using clean water

AND either

- burning, (if allowed by municipal by-laws) in circumstances that persons and animals are kept out of any smoke produced and any smoke is directed away from buildings, highways, roads, or outdoor areas frequented by the public

OR

- taking it to a licensed waste disposal site. (Reg. 914, s. 27)

Paper or cardboard containers are often rigid enough to withstand rinsing. If possible, triple rinse these containers as you fill the tank. Then burn the containers in an isolated area on your farm.

Be very careful around the smoke. It may contain toxic fumes from the burning pesticide. Be certain there is no chance that a person or animal may breathe in this smoke. Make sure the smoke does not drift toward buildings, roads, or any public outdoor areas.

These containers can also be taken to a local waste disposal site in the same way as metal, plastic, or glass containers. If you can't dispose of them immediately, make sure containers are kept in a secure place such as the pesticide storage area.

Unwanted Pesticides

If you have pesticides you do not need or cannot use, be sure to dispose of them safely.

- Contact the supplier. It is sometimes possible to return unused pesticide if it is still in its original container.
- If you cannot find any way to use the product as shown on the label, then the Ministry of the

Environment requires that waste be disposed of by licensed waste haulers to a licensed waste disposal site. Look in the Yellow Pages of your telephone directory under Liquid Waste Removal.

- Watch your local paper for Municipal Waste Collection Days or contact your municipality. If your municipality has no waste collection days, encourage them to sponsor such an event. On these days, you can turn over surplus pesticide concentrates (maximum 25 L) for disposal.
- Consult with the regional Ministry of the Environment Office for more information. (See Appendix B on page 30 for a list of MOE offices.) The Ministry has an agreement with Safety-Kleen to dispose of unwanted pesticides on a user-paid basis. Contact Safety-Kleen in London, Ontario at (519) 451-6630 for disposal of unwanted or contaminated pesticides

Surplus Spray Mix

The best way to dispose of any excess spray mix is to find other crops that require an application of this pesticide. Before spraying, check the label to make sure the pesticide is registered for use on that crop.

If you can't find another crop to spray, then dilute the remaining spray mix by adding 10 parts of water for each 1 part of spray mix. This diluted solution can be safely applied to the treated area as long as you do not exceed the pesticide rate recommended on the label. Be sure to check the label for any restrictions about crop rotation, days to harvest, or surplus spray mix disposal.

NEVER respray the treated crop with undiluted spray mix. Spraying an area twice will double the recommended pesticide rate. This may cause illegal pesticide residues in the harvested crop or harmful residues in the soil that can cause crop damage.

Soluble Packaging Options

Choose soluble packages that dissolve in the spray tank to reduce container disposal. Water-soluble packaging is used for dry flowable and wettable powder formulations of pesticides and is available under names such as Clean Pak and Solupak. In most cases, the water-soluble packaging material is PVA (polyvinyl alcohol). This material dissolves completely when added to the water in the sprayer tank according to instructions.

Read all labels and instructions carefully. For more details contact your vendor.

Keep soluble pouches dry until you add them to the spray tank.

- Do not handle pouches with wet hands or wet gloves.
- Do not remove pouches from the outer package until you are ready to add them.
- Always reseal the outer package to protect the remaining pouches from moisture.

Mixing Soluble Pouches

- Consult product labels for specific mixing instructions for each product.
- Fill the spray tank 1/4 full of water and have the agitator running — then add the water-soluble pouches to the tank.
- Most pouches dissolve completely within 5 minutes, depending on the water temperature and the degree of agitation.
- As the tank continues to fill, add any other compatible pesticides.

Do not add:

- a pesticide that is incompatible with the PVA packaging material. PVA material is not soluble with summer-type oils (e.g., Superior Oil).
- any material containing boron (e.g., Solubor) chelated micronutrients or water-soluble fertilizers. This combination is likely to cause a sticky, insoluble substance in the tank. If you apply boron, chelated micronutrients or water-soluble fertilizers, make sure you completely empty and rinse the spray tank before you use any product packaged in PVA.

Storing Pesticides

Ontario's *Pesticides Act* and Regulation 914 gives storage requirements for storage facilities. The storage requirements you must follow depend on which Schedules of pesticides you store.

Table 1-4. *Pesticides Act* storage requirements

	Sch. 3, 4 & 6	Sch. 2	Sch. 1 & 5
No contact with food or drink	♦	♦	♦
Not impair health/safety	♦	♦	♦
Clean & orderly manner	♦	♦	♦
Warning signs posted on storage buildings	♦	♦	♦
Warning signs posted on unattended vehicles	♦	♦	♦
Emergency telephone numbers posted	♦	♦	♦
Ventilated to outside		♦	♦
Limited access (locked)		♦	♦
No floor drain		♦	♦
Safety equipment available		♦	♦
Area used exclusively for pesticides			♦

Pesticide Spills

Protect yourself before you begin to clean up any spill. Clean up spills immediately.

In the case of minor spills

- for liquids, cover the spill with a thick layer of absorbent material such as kitty litter, vermiculite or dry soil. Sweep or shovel the material into a waste drum.
- for powders and granulars, sweep or shovel the material into a waste drum.

In the case of a major spill

- remove any people or animals from the spill area.
- stop the spill from spreading.
- do not let the pesticide enter any watercourse.

If a pesticide spill causes, or is likely to cause, an adverse effect, you must notify the Ministry of Environment, Spills Action Centre at 1-800-268-6060 (24 hrs a day, 7 days a week) and the municipality.

For information on preventing spills see OMAF Factsheet, *Ways to Avoid Pesticide Spills*, Order No. 96-025.

Application Procedures

Sprayers

- Sprayers that can deliver enough litres per hectare for adequate coverage are satisfactory for applying emulsion-type insecticides.
- If 2,4-D or related herbicides are used, clean the sprayers thoroughly with detergent containing ammonia to prevent crop damage.
- Adequate agitation is essential when applying wettable powder formulations.
- Pumps should be capable of delivering the flow and pressure required as well as being compatible with materials sprayed.
- Keep in mind that the higher the pressure, the greater the danger of drift to other crops.
- Calibrate your sprayer at least twice during the growing season with each set of nozzles used. The wear on nozzles and other parts will alter the amount of spray delivered.
- Check all nozzles for flow rate at least once a year. Replace nozzles when their output is 10% greater than rated output.
- For information on calibration, see the current OMAF Publication 75, *Guide to Weed Control* or the OMAF Web site at www.gov.on.ca/OMAF/english/crops/.

General Precautions and Requirements for Fumigants (Gases, Vapours and Fumes/Smokes)

Read and follow all instructions on the product label regarding protective clothing and equipment, aeration of treated areas, and re-entry periods.

- Lock the building and post warning signs.
- **If you use a fumigant gas** to fumigate a structure you must hold the appropriate license and obtain a permit issued under Ontario's *Pesticides Act*. To apply for a permit, contact the regional pesticides officer with the Ontario Ministry of the Environment.
- As a safety precaution, have someone else who is wearing personal protective equipment help with the fumigation. (This is a requirement for all fumigant gas use.)

Coated Spawn Treatments

Remember that coated spawn treatments are also pesticides.

- Spawn coated with pesticides is poisonous to people and animals.
- Wear protective clothing and equipment when you are treating spawn, or handling treated seed. Protect your skin – wear a long-sleeved shirt and long pants or coveralls, and wear neoprene or nitrile gloves. Protect your eyes with goggles or a face shield.
- Wash thoroughly after finishing the treatment or handling the treated spawn.
- Never feed treated spawn to animals.
- Keep treated spawn out of reach of children.
- Destroy all the bags that have had treated spawn as recommended in the container disposal section by burning or by taking to a licensed waste disposal site.

Table 1-5. Pesticides listed in this publication

Common or chemical name	Brand or trade name	Schedule	Common or chemical name	Brand or trade name	Schedule
ammonium chlorides	Verticide		dimethoate	Clean Crop Lagon 480 E Insecticide	2
benomyl[1]	Benlate 50 WP	3	dimethoate	IPCO Cygon 4-E	2
benomyl[1]	Benlate Toss-n-Go	3	dimethoate	Dimethoate Plus Emulsifiable Liquid Insecticide	2
chlorothalonil	Bravo 500	3	formaldehyde	Clean Crop Formalin Fungicide Solution	3
copper 8-quinolinolate	PQ-57 Wood Preservative	3	malathion	Clean Crop Malathion 85 E	2
cyromazine	Citation 75 WP	2	malathion + pyrethrin	Clean Crop Mushroom Fly Dust	6
diazinon	Clean Crop Diazinon 500 E	2	malathion	Clean Crop Malathion 500 E	3
diazinon	Clean Crop Diazinon 500	2	malathion	Clean Crop Malathion 25 W	3
diazinon	Clean Crop Diazinon 50 W	2	malathion	Dispar Malathion 50	3
diazinon	DZN 600 EW	2	malathion	Fyfanon 50% Emulsifiable Concentrate Insecticide	3
diazinon	Diazol 50 W Insecticide Wettable Powder	2	malathion	Fyfanon 25% WP	3
diazinon	Diazol 50 EC Emulsifiable Concentrate Insecticide	2	malathion	Wilson Malathion 50 EC	3
diazinon	Ditchling Diazinon 50 E	2	methoprene	Apex Insect Growth Regulator	2
diazinon	IPCO Diazinon 500 EC	2	methoxychlor	Clean Crop Methoxychlor 240 Insecticide	3
diazinon	Plant Products Diazinon 500 EC	2	permethrin	Ambush 500 EC Emulsifiable Concentrate Insecticide	3
diazinon	Wilson Diazinon 50 EC	2	permethrin	Pounce	3
dichlorvos	Ditchling DDVP - 5FS Fogging Solution Insecticide	3	propiconazole	Safetray P Wood Preservative for the Mushroom Industry	2
dichlorvos	Vapona Insecticide Industrial Fogging Solution	3	pyrethrin	Wilson P-100 Mushroom House Insecticide	6
dimethoate	Cheminova Cygon 480 Systemic Insecticide	2	zineb	King Mushroom Dust	3
dimethoate	Cheminova Cygon 480 AG Systemic Insecticide	2	zineb	Zineb 15 Dust	3

Schedule 1 Restricted. Use by permit only.
Schedule 2 Restricted to agriculturalists, licensed exterminators and registered custom sprayers.
Schedule 3 May be available for domestic purposes if so registered.
Schedule 4 Domestic products only.
Schedule 5 Limited to application by an agriculturalist.
Schedule 6 Similar to Schedule 4 but may be registered for agricultural or commercial use.

1 Benlate 50 WP and Benlate Toss-N-Go will be illegal to use after September 30, 2003.

2. Insects

Three families of insects cause problems in mushroom cultivation: sciarids, phorids and cecids. Sciarids are almost without exception the only problem group. Phorids and cecids have been seen only rarely.

Sciarid fly (dark-winged fungus gnat)

Lycoriella mali

Mature sciarid fly larvae are about 7 mm long and have a white, translucent body and black head capsule. Adults measure about 5 mm long, with distinctive forked and cross veins in the wing.

This fly usually invades the mushroom crop near the time of spawning and begins laying eggs at the first available site. The larvae hatch within 4 days. The four larval stages last about 14 days, and during that time they may feed on the spawn grains, mushroom compost, mycelium and mushrooms. After the larvae stop feeding and enter the pupae stage, adult flies emerge within 7 days. Depending on crop cycle length, there may be 2 or more complete generations before the compost is removed.

Sciarid larvae can consume the total contents of developing mushroom pins. These mushrooms will appear glossy and light brown, and the cap may be completely perforated and, when picked, the tissues will crumble. Mushrooms that are larger when attacked show black necrotic areas in the stem where the larvae have made feeding galleries. Some larvae do not tunnel into the stem but consume the mycelium at the base of the stem, in which case the mushroom does not develop normally.

If diseases, mites or nematodes are present on the farm, adult flies can carry them from one area to another.

Phorid flies

Megaselia halterata

Phorid larvae are white, without an apparent head capsule, and about 4 mm long. The adults of both sexes are small, measure 2 to 3 mm, lack forked and cross veins in the wings, and are easily recognized by their humpbacked appearance and quick, jerky movements.

Adult females are attracted to actively growing mycelium after spawning and casing and lay their eggs near the mycelial tips. Unspawned compost does not support reproduction. The average time from egg to adult at 16°C and 24°C is 51 and 37 days respectively, with adults surviving 4 to 8 days. Phorid flies are very easily attracted to light. Outside flight activity is generally restricted to the daylight hours.

Larvae of the phorid fly feed at the growing tips of the mushroom mycelium. This species does not tunnel into the mushroom. Although direct yield loss can be a problem, the greater threat is the transmission of diseases.

The integrated pest management strategies for control of sciarid flies are effective in managing phorid flies.

Cecids (gall midges)

Mycophila spp.

Cecids are small, rarely seen flies, about 1.5 mm long. However, when populations are high their larvae are readily noticed because they wander off the shelves and accumulate in heaps on the floor. Larvae are white or orange, depending on the species. Mature larvae are about 2 mm long.

These flies reproduce without going through the adult stage. A mature larva may give birth to 12 to 20 daughter larvae in about 7 days without becoming an adult and mating.

Larvae feed on the outside of the stem or at the junction of the stem and gills of both the commercial button mushroom and the oyster mushroom. Their presence can result in a loss of volume of fresh or processed marketable product. They also carry bacteria that induce browning.

Cecids are associated with infested casing material, especially peat, and they disperse on inadequately cleaned growing surfaces and especially on tools, equipment, and workers' shoes and clothing.

Any practice that minimizes fly dispersal contributes to cecid control.

Control measures

Physical and cultural management

1. Keep flies from getting into the building initially. This is the most effective means of avoiding fly problems. All non-chemical means of fly prevention provide the most effective and reliable means of control. Caulk cracks in walls and around air-conditioners and pipes. Use netting on doors, vents, windows and ventilators.
2. Be aware that the most critical period for fly control is cool-down through spawn-run.
   - Shorten the cool-down period, so that there is less time for the sciarid fly to enter.
   - Restrict movement into the room or tunnel area used for Phase II to a minimum during this period.
   - Close doors when applying pesticides. Make a small opening in the wall next to the door through which hoses can pass and plug the hole when you're not using it.
   - If Phase II is in shelves or trays, install a fly monitor on the inside wall of each Phase II room during cool-down when the air temperature drops to 40°C. Record the fly counts daily for use in making pest management decisions. Generally, the presence of one fly on the monitor signals when to apply chemicals during the pre-spawning and spawn-run period. You may find your farm can tolerate higher numbers without adverse effects. Set your own number (action threshold) for taking action and applying pesticide.
   - If Phase II or the spawn-run is "in bulk", maintain a fly monitor in the work areas. Check monitor for presence of flies.
   - During spawning, keep doors closed as much as possible. Make a small opening next to the door for hydraulic hoses.
   - Cover the compost with plastic after spawning. This will keep out flies and diseases and maintain higher moisture level for better production.
   - Use a short spawn-run to shorten the crop cycle, thus reducing the number of flies.
3. During the casing operation, minimize the size of the open areas and the length of time that the room is open.
4. Shorten the time from casing to first pick by using a casing inoculum.
5. Prevent flies from leaving production rooms by keeping the doors closed and sealing any cracks.
6. Terminate the crop early to reduce the spread of insects and disease to newer rooms.
7. Shorten the crop to three breaks to reduce insect and disease problems on commercial farms.
8. Steam-off crop when harvesting is finished and before emptying by raising compost temperature to at least 65°C for a minimum of 12 hours.
9. Remove spent compost from farm.

Timing

Cultivation of the commercial mushroom is described by phases and time intervals.

Compost preparation

The first phase of compost preparation takes place in windrows or bunkers. Pesticides may be mixed into the growth medium prior to transfer to the second phase for pasteurization and conditioning.

Cool-down and pre-spawning

After the compost is pasteurized and conditioned, it must be cooled to a temperature that will not harm the mycelium when it is introduced. Pesticide products can be used on structural surfaces or in the air during this period of temperature decline and before the mushroom spawn is added.

Spawning

The mushroom growing medium is inoculated with the mushroom mycelium (spawn) that is growing on a cereal grain. Pesticides may be added during the inoculation.

Spawn-run and pre-casing

The mushroom mycelium grows throughout the substrate, called spawn-run. After about 2 weeks, the substrate is covered with a layer of buffered peat moss (casing). During this mycelial growth stage and before the covering of the colonized substrate with the peat moss, pesticide products can be applied to surfaces or the air.

Casing and pre-production

Once the colonized compost is covered with the peat moss, there is an interval where the mushroom mycelium grows within the casing. During this interval, products can be applied to structural surfaces, to the growing medium or air to control insects or diseases.

Production

Once the crop is in the harvesting stage, products may be applied to structural surfaces, the growing medium or air.

Between crops

For about 3 weeks after harvesting, the medium is discarded and replaced with fresh growing medium. This interval between old and new crops is important in managing insects and disease.

Table 2-1. Application during compost preparation

Chemical	Product	Rate	Comments
cyromazine	Citation 75 WP	5 ppm active ingredient (wet weight)	Apply Citation during compost preparation using a coarse drenching spray with low pressure to minimize the formation of mists. Apply in enough water for uniform distribution. Thoroughly incorporate in the compost. Applying the product before the fill-turn will provide a good mix. The volume of product will vary depending on the weight and moisture of compost being turned. See label for specific rates.

Table 2-2. Application during cool-down and pre-spawning—Surface residual sprays

Chemical	Product	Rate in water	Comments
diazinon	Clean Crop Diazinon 500	2–4 L/100 L	Spray on outside and inside walls and ventilators during cool-down. Do not spray on compost or after spawning. Brush on side boards, support posts and door frames.
	Clean Crop Diazinon 500 E		
	Clean Crop Diazinon 50 W	1–2 kg/100 L	
	Diazol 50 EC (Diazinon) Commercial	1–2 L/100 L	
	Diazol 50 W (Diazinon) Commercial	1–2 kg/100 L	
	DZN 600 EW	0.83–1.7 L/100 L	
	Ditchling Diazinon 50E	1 L/100 L	
	IPCO Diazinon 500 EC	1–2 L/100 L	
	Plant Products Diazinon 500 EC		
	Wilson Diazinon 50 EC		
dimethoate	Cheminova Cygon 480	1.2 L/100 L*	Spray on inside walls during cool-down. Do not spray on compost or after spawning. Do not allow the solution to get onto the casing material or mushrooms. Brush on side boards, support posts and door frames.
	Cheminova Cygon 480-AG		
	Clean Crop Lagon 480	1.25 L/100 L	
	Dimethoate Plus Emulsifiable Liquid Insecticide	1.5 L/100 L	
	IPCO Cygon 4-E	1.25 L/100 L	
malathion	Clean Crop Malathion 85E	115–150 mL/100 L	Spray on inside walls during cool-down. Spray or brush on side boards, support posts and door frames. Do not spray on compost.
	Clean Crop Malathion 500E	230–360 mL/100 L	
	Cheminova Fyfanon 50% EC		
	Cheminova Fyfanon 25% WP	415–625 g/100 L	
	Clean Crop Malathion	400–600 g/100L	
	25WP Dispar Malathion 50	200–300 mL/100 L	
methoxychlor	Clean Crop Methoxychlor 240 EC	2 L/100 L	Spray on inside walls and woodwork, applying 5 litres of solution per 100 m^2 of surface during cool-down when air is below 32°C. Do not spray ceilings or compost.

Table 2-3. Application during cool-down and pre-spawning—Flying insects

Chemical	Product	Rate in water	Comments
			Apply when flies are seen on the monitor.
dibrom dichlorvos	Ditchling DDVP-5FS Vapona Insecticide Industrial Fogging Solution	20 mL/100 m^3	Apply as a dry fog using thermal or mechanical (electrical) fogging equipment. Treat at room temperature of about 21°C. Close all windows, doors and ventilators. Wear a full-face respirator while applying chemical. Direct fog down and away from compost. After exposure for one hour, ventilate thoroughly before resuming work.
malathion	Clean Crop Mushroom Fly Dust	375 g/100 m^2 of shelf surface	Apply with a good dusting machine. Rooms should be as dry as possible, the doors closed and the air temperature greater than 15°C.
permethrin	Ambush 500 EC Emulsifiable Concentrate Pounce	50–65 mL/1 L water/1000 m^3 65–85 mL/1 L water/1000 m^3	Apply as a cold fog or aerosol. Treat at room temperatures between 12°C and 30°C. Close all windows, doors and ventilators. Wear a full-face respirator while applying chemical. Direct fog down and away from compost. After exposure for one hour, ventilate thoroughly before resuming work. Up to 20 applications can be made prior to pinning.
pyrethrin	Wilson P-100 Mushroom House Insecticide	50 mL/100 m^3	Use undiluted in a thermal or mechanical (electrical) fog generator that will produce small dry particles. Close all windows, doors and ventilators. Direct fog down and away from compost. After exposure for at least one hour, ventilate thoroughly before resuming work.

Table 2-4. Application during spawn-run and pre-casing—Surface residual sprays

Chemical	Product	Rate in water	Comments
diazinon	Diazol 50 EC (Diazinon) Commercial Diazol 50 W (Diazinon) Commercial	1–2 L/100 L 1–2 kg/100 L	Spray on outside and inside walls and ventilators during cool-down. Do not allow the material to get onto compost, casing materials or mushrooms.
	Clean Crop Diazinon 500 Clean Crop Diazinon 500 E	2–4 L/100 L	Brush on wooden side boards, support posts and door frames. Do not allow the material to get onto compost, casing materials or mushrooms. Repeat if needed.
	Clean Crop Diazinon 50 W	1–2 kg/100 L	
	Diazol 50 EC (Diazinon) Commercial	1 L/100 L	
	Diazol 50 W (Diazinon) Commercial	0.5 kg/100 L	
	DZN 600 EW	0.83 L/100 L	
	Ditchling Diazinon 50E	1 L/100 L	
	IPCO Diazinon 500 EC		
	Plant Products Diazinon 500 EC		
	Wilson Diazinon 50 EC		
malathion	Cheminova Fyfanon 50% EC	230–360 mL/100 L	Spray on inside walls during cool-down. Spray or brush on side boards, support posts and door frames. Do not spray on compost.
	Cheminova Fyfanon 25% WP	415–625 g/100 L	
	Clean Crop Malathion 85E	115–150 mL/100 L	
	Clean Crop Malathion 500E	230–380 mL/100 L	
	Clean Crop Malathion 25WP	400–600 g/100 L	
	Diaper Malathion 50	200–300 mL/100 L	
methoxychlor	Clean Crop Methoxychlor 240 EC	2 L/100 L	Spray on inside walls and woodwork, applying 5 litres of solution per 100 m^2 of surface. Do not spray ceilings or compost. Apply no later than 4 days before casing.

Table 2-5. Application during spawn-run and pre-casing—Flying insects

Chemical	Product	Rate	Comments
			Apply when flies are seen on the monitor.
ddvp dichlorvos	Ditrifrog DDVP-SFS Vapona Insecticide Industrial Fogging Solution	20 mL/100 m^3	Apply as a dry fog using thermal or mechanical (electrical) fogging equipment. Treat at room temperature of about 21°C. Close all windows, doors and ventilators. Wear a full-face respirator while applying chemical. Direct fog down and away from compost. After exposure for one hour, ventilate thoroughly before resuming work.
malathion	Clean Crop Mushroom Fly Dust	375 g/100 m^2 of shelf surface	Apply with a good dusting machine. Rooms should be as dry as possible, the doors closed and the air temperature greater than 15°C.
permethrin	Ambush 500 EC Emulsifiable Concentrate Pounce	50–65 mL water/1 L/1000 m^3 65–85 mL water/1 L/1000 m^3	Apply as a cold fog or aerosol. Treat at room temperatures between 12°C and 30°C. Close all windows, doors and ventilators. Wear a full-face respirator while applying chemical. Direct fog down and away from compost. After exposure for 1 hour, ventilate thoroughly before resuming work. Up to 20 applications can be made prior to pinning.
pyrethrin	Wilson P-100 Mushroom House Insecticide	50 mL/100 m^3	Use undiluted in a thermal or mechanical (electrical) fog generator that will produce small dry particles. Close all windows, doors and ventilators. Direct fog down and away from compost. After exposure for at least one hour, ventilate thoroughly before resuming work.

Table 2-6. Application during spawn-run and pre-casing—Immature or larval stages of flies

Chemical	Product	Method	Comments
cyromazine	Citation 75 WP	5 ppm active ingredient (wet weight)	Apply to compost at spawning using a coarse drenching spray with low pressure to minimize mists. Apply in enough water for uniform distribution to the compost. Thoroughly incorporate in the compost. The volume of product will vary depending on the weight and moisture of compost being spawned. See label for specific rates.
methoprene	APEX Insect Growth Regulator	**15-day or less spawn-run** In compost In casing	Apply at spawning, using the rate of 175 mL/100 m^2 in adequate water for even distribution. Spray on compost surface at spawning and thoroughly incorporate using a spawning machine or other suitable mechanical means. See *Table 2-8. Application during casing and pre-production—Immature or larval stages of flies* on page 19.
		16-day or longer spawn-run First application, on compost Second application, in casing	For crops with a 16-day or longer spawn-run, use a split application. Apply to the compost surface 12 to 13 days after flies first appear on the monitor. Use 88 mL/100 m^2 in enough water for even distribution. See *Table 2-8. Application during casing and pre-production—Immature or larval stages of flies* on page 19.

Table 2-7. Application during casing and pre-production—Surface residual sprays

Chemical	Product	Rate in water	Comments
diazinon	Diazol 50 EC (Diazinon) Commercial Diazol 50 W (Diazinon) Commercial	1–2 L/100 L 1–2 kg/100 L	Spray on outside and inside walls and ventilators during cool-down. Do not allow the material to get onto compost, casing materials or mushrooms.
	Clean Crop Diazinon 500 Clean Crop Diazinon 500 E Clean Crop Diazinon 50 W Diazol 50 EC (Diazinon) Commercial Diazol 50 W Diazinon) Commercial DZN 600EW Ditchling Diazinon 50E IPCO Diazinon 500 EC Plant Products Diazinon 500 EC Wilson Diazinon 50 EC	2–4 L/100 L 1–2 kg/100 L 1 L/100 L 0.5 kg/100 L 0.83 L/100 L 1 L/100 L	Brush on wooden side boards, support posts and door frames. Do not allow the material to get onto compost, casing materials or mushrooms. Repeat if needed.
malathion	Chemnova Fyfanon 50% EC Chemnova Fyfanon 25% WP Clean Crop Malathion 85E Clean Crop Malathion 500 E Clean Crop Malathion 25WP Dragar Malathion 50	230–360 mL/100 L 415–625 g/100 L 115–150 mL/100 L 230–360 mL/100 L 400–600 g/100 L 200–300 mL/100 L	Spray on inside walls. Spray or brush on side boards, support posts and door frames. Do not spray on compost. Avoid spraying on the casing surface if less than 2 days to harvest.
methoxychlor	Clean Crop Methoxychlor 240 EC	1 L/100 L	Spray on inside walls and woodwork, applying 5 litres of solution per 100 m^2 of surface. Do not spray ceilings or compost. Apply no later than 7 days after casing.

Table 2-8. Application during casing and pre-production—immature or larval stages of flies

Chemical	Product	Method	Comments
methoprene	APEX Insect Growth Regulator	Casing only	Apply at 175 mL/100 m^2 of production surface. Make application evenly, and mechanically mix into casing material before casing operation, or evenly drench onto the casing surface immediately after placement.
		15-day or less spawn-run In compost In casing	See *Table 2-6: Application during spawn-run and pre-casing—immature or larval stages of flies* on page 18. Apply at 70 mL/100 m^2 of production surface. Make application evenly, and mechanically mix into casing material before casing operation, or evenly drench onto the casing surface immediately after placement.
		16-day or longer spawn-run First application, on compost Second application, in casing	For crops with a 16-day or longer spawn-run, use a split application. See *Table 2-6: Application during spawn-run and pre-casing—immature or larval stages of flies* on page 18. Apply at 88 mL/100m^2 of production surface. Make application evenly and mechanically mix into casing material before casing operation, or evenly drench onto the casing surface immediately after placement.
nematodes		At casing	Apply in the irrigation water. Effectiveness of nematodes will vary with species and biotype. Check with your supplier for recommended rates, species and use patterns.

Table 2-9. Application during casing and pre-production—Flying insects

Chemical	Product	Rate	Comments
			Apply when flies are seen on the monitor.
ddvp, dichlorvos	Ditchling DDVP-5FS Vapona Insecticide Industrial Fogging Solution	20 mL/100 m^3	Apply as a dry fog using thermal or mechanical (electrical) fogging equipment. Treat at room temperature of about 21°C. Close all windows, doors and ventilators. Wear a full-face respirator while applying chemical. Direct fog down and away from compost. After exposure for one hour, ventilate thoroughly before resuming work.
malathion	Clean Crop Mushroom Fly Dust	375 g/100 m2 of shelf surface	Apply with a good dusting machine. Rooms should be as dry as possible, doors closed and air temperature greater than 15°C.
permethrin	Ambush 500 EC Emulsifiable Concentrate Pounce	50–65 mL/1 L water/1000 m^3 65–85 mL/1 L/water 1000 m^3	Apply as a cold fog or aerosol. Treat at room temperatures between 12°C and 30°C. Close all windows, doors and ventilators. Wear a full-face respirator while applying chemical. Direct fog down and away from compost. After exposure for one hour, ventilate thoroughly before resuming work. Up to 20 applications can be made before pinning.
pyrethrin	Wilson P-100 Mushroom House Insecticide	50 mL/100 m^3	Use undiluted in a thermal or mechanical (electrical) fog generator that will produce small dry particles. Close all windows, doors and ventilators. Direct fog down and away from compost. After exposure for at least one hour, ventilate thoroughly before resuming work.

Table 2-10. Application during production—Surface residual sprays

Chemical	Product	Rate in water	Comments
diazinon	Diazol 50 EC (Diazinon) Commercial	1–2 L/100 L	Spray on outside and inside walls and ventilators during cool-down. Do not allow the material to get onto compost, casing materials or mushrooms.
	Diazol 50 W (Diazinon) Commercial	1–2 kg/100 L	
	Clean Crop Diazinon 500 Clean Crop Diazinon 500 E	2–4 L/100 L	Brush on wooden side boards, support posts and door frames. Do not allow the material to get onto compost, casing materials or mushrooms. Repeat if needed.
	Clean Crop Diazinon 50 W	1–2 kg/100 L	
	Diazol 50 EC (Diazinon) Commercial	1 L/100 L	
	Diazol 50 W (Diazinon) Commercial	0.5 kg/100 L	
	DZN 600 EW	0.83 L/100 L	
	Ditchling Diazinon 50E IPCO Diazinon 500 EC Plant Products Diazinon 500 EC Wilson Diazinon 50 EC	1 L/100 L	
malathion	Clean Crop Malathion 85E	115–150 mL/100 L	Spray on inside walls. Spray or brush on side boards, support posts and door frames. Do not spray on compost.
	Dispar Malathion 50	200–300 mL/100 L	
	Clean Crop Malathion 500E Cheminova Fyfanon 50% EC	230–360 mL/100 L	
	Cheminova Fyfanon 25% WP	415–625 g/100 L	
	Clean Crop Malathion 25WP	400–600 g/100 L	

Table 2-11. Application during production—Immature or larval stages of flies

	Product	Amount	Comments
malathion	Cheminova Fyfanon 50% EC	25–40 mL	Mix in enough water to cover 100m^2 of casing surface. Drench onto casing after picking but not within 2 days of harvest.
	Cheminova Fyfanon 25% WP Clean Crop Malathion 25WP	50–75 g	
	Clean Crop Malathion 85EC	15–20 mL	
	Clean Crop Malathion 500 E	25–40 mL	
	Dispar Malathion 50	25–35 mL	
	Wilson Malathion 50 EC	25–40 mL	
nematodes			Apply in the irrigation water. Effectiveness of nematodes will vary with species and strain. Check with your supplier for recommended rates, species and use patterns.

Table 2-12. Application during production—Flying insects

Chemical	Product	Rate	Comments
			Apply when flies are seen on the monitor.
ddvp, dichlorvos	Ditchling DDVP-5FS Vapona Insecticide Industrial Fogging Solution	20 mL/100 m^3	Apply as a dry fog using thermal or mechanical (electrical) fogging equipment. Treat at room temperature of about 21°C. Close all windows, doors and ventilators. Wear full-face respirator while applying. Direct fog down and away from compost. After exposure for 1 hour, ventilate thoroughly before resuming work. Do not apply within 1 day of harvest.
malathion	Clean Crop Mushroom Fly Dust	375 g/100 m^2 of shelf surface	Apply with a good dusting machine. Rooms should be as dry as possible, doors closed and air temperature greater than 15°C. Do not apply within 2 days of harvest.
permethrin	Ambush 500 EC Emulsifiable Concentrate	50–65 mL/1 L water/1000 m^3	Apply as a cold fog or aerosol. Treat at room temperatures between 12°C and 30°C. Close all windows, doors and ventilators. Wear a full-face respirator while applying chemical. Direct fog down and away from compost. After exposure for 1 hour, ventilate thoroughly before resuming work. Ten applications can be made during production. Do not apply more than 2 applications between breaks. Do not apply within 1 day of harvest
	Pounce	65–85 mL/1 L water/1000 m^3	
pyrethrin	Wilson P-100 Mushroom House Insecticide	50 mL/100 m^3	Use undiluted in a thermal or mechanical (electrical) fog generator that will produce small dry particles. Close all windows, doors and ventilators. Direct fog down and away from compost. After exposure for at least 1 hour, ventilate thoroughly before resuming work. Do not apply within 1 day of harvest.

Red pepper mites

Pygmephorus spp.

Red pepper mites, also known as pyemotid or pigmy mites, feed on moulds (*Trichoderma, Monilia,* and *Humicola spp.*). These mites can carry disease organisms from infected areas to clean ones. They seem to be found only on the commercial button mushroom, where they may cause losses in marketable yield. As well, they are a nuisance to mushroom harvesters.

These mites (family Pyemotidae) are tiny, 0.25 mm long, and brown. Because they tend to congregate on top of the mushroom caps, they can be seen by shining a light across the mushrooms.

The mites have a sexual adult stage and a generation time of 4–5 days. Adult females may lay up to 160 eggs over 5 days.

Cultural management

These mites disperse on inadequately sterilized production surfaces and on workers' clothing and can be carried by sciarid flies. Proper preparation and pasteurization of compost to mini-

mize weed moulds reduces or eliminates red pepper mites. Any practices that minimize these factors contribute to mite control.

Chemical management

Use surface residual sprays as outlined in *Table 2-2. Application during cool-down and pre-spawning—Surface residual sprays* on page 16, *Table 2-4. Application during spawn-run and pre-casing—Surface residual sprays* on page 17, *Table 2-7. Application during casing and pre-production—Surface residual sprays* on page 19 and *Table 2-10. Application during production—Surface residual sprays* on page 20.

Maintain a good fly control program.

If mites are on casing, use malathion as outlined in section on Sciarid fly, *Table 2-11. Application during production—Immature or larval stages of flies* on page 21.

Nematodes

Two types of nematodes can be problematic in mushroom compost or casing.

Saprophagous nematodes have sucking mouthparts that are incapable of piercing mushroom mycelium. These nematodes feed on bacteria in the compost and casing. Saprophagous nematodes can indicate that some segment of the production cycle was performed incorrectly. High populations can be associated with wet compost or a slimy layer between the casing and the compost. These nematodes move only in water films. Creating dry conditions in the casing slows their development, but mushroom production will suffer.

Saprophytic nematodes may cause reduction in yield and quality. Typical symptoms may be reduced mycelial growth into casing, poor or spotty pinning, or a drop in production or quality. The fungus feeding, or stylet bearing, nematode can feed directly on mushroom mycelium by penetrating the cell wall and draining the contents. This type has been a problem in the past but is not now found in samples examined at the branch campus of the University of Guelph at Vineland Station.

Some nematodes can be beneficial and can be used to control sciarid flies. They do not feed in the compost or casing nor do they affect mushroom production when used at recommended rates.

Cultural management

Since the species of saprophagous nematodes found in Canada do not form a resting stage, they can virtually be eradicated by a proper Phase II and good sanitation practices.

Immature stages of the saprophagous nematodes can survive the dry compost surfaces during Phase II. Avoid over-drying of the compost surface prior to pasteurization.

Certain factors tend to favour nematode multiplication and subsequent damage:

- There is greater multiplication in unspawned compost than in casing soil.
- Off-white strains are less tolerant to nematodes than white strains.
- Watering compost at spawning favours population increases.
- Ruffling the casing tends to stimulate multiplication.
- Nematodes multiply more rapidly in younger spawn-run than in mature spawn-run.

Maintaining a good fly control program will help.

Note: Before you use a pesticide, read the chapter on Precautions with Pesticides.

3. Diseases

General cultural management

Proper cultural practices and strict adherence to sanitation and hygiene are essential to an effective disease prevention program. Many of these practices are effective for the control of all mushroom diseases.

1. Practise strict sanitation.
   - Remove stumps, trash and diseased mushrooms from production surfaces and farm premises daily. Keep floors clean. Do not sweep dry floors vigorously .
   - Deal with disease when it first appears. Cover diseased mushrooms before watering with salt (NaCl) or a 50:50 mixture of salt and gypsum or hydrated lime.
   - Do not let workers stand on side boards.
   - Keep equipment clean.
   - Steam-off crop when harvesting is finished and before emptying by raising compost temperature to 65 C for at least 8 hours. Remove spent compost and mushroom trash as far from the production area as possible. In case of green mould disease at least 24 hours at 65 C is desired. If virus disease is present, then the compost temperature should be raised to 70 C for 12 hours.
   - Clean and disinfect equipment used in and around mushroom facilities, such as picking boxes, trash boxes, shovels or spawning machines before each use. Clean the equipment with water, then disinfect with a sanitizer (See *Table 3-1. Sanitation of non-porous and non-food contact surfaces* on page 24.) Dip or spray the equipment thoroughly. Rinse with clean water if equipment is to be used soon after treatment.
   - Clean hallways at end of work day. Remove gross filth and heavy soil deposits. Clean with water then apply sanitizer. (See *Table 3-1. Sanitation of non-porous and non-food contact surfaces* on page 24.)
2. Store and mix casing material on concrete, preferably under cover. Protect casing material from contamination by compost, soil and ground water. Prepare casing material in a clean area, preferably a container such as a converted cement mixer that has been cleaned with water or formaldehyde solution or both. The area should be free of dust and insects. Avoid cross-over of workers between dirty and clean areas.
3. Disinfect casing with formaldehyde. See *Table 3-5. Application during casing and pre-production— Dry bubble, wet bubble, cob web and green moulds* on page 26.
4. Install high-efficiency (95% dust spot efficiency) air filters in ventilation systems.
5. Clean spawning or casing tools and equipment by washing with water, then sanitize by dipping or spraying them (see *Table 3-1. Sanitation of non-porous and non-food contact surfaces* on page 24). The spawning crew should not have had contact with compost, spent compost, or diseased mushrooms before spawning or casing. Wear clean work clothes. Wash shoes and boots and dip them in disinfectant (see *Table 3-1. Sanitation of non-porous and non-food contact surfaces* on page 24).
6. Between crops, remove gross filth with shovel and broom. Clean the room with water. Sanitizers may be applied (see *Table 3-2. Between crops disinfection—Surfaces* on page 24) or the room steam heated empty for 8 hours at 65 C or both.
7. Between crops, clean wood and treat with a wood preservative (see *Table 3-3. Between crops—Wood treatment* on page 24).
8. Store spawn in clean, cool area away from other mushrooms.
9. Minimize dusty conditions on roadways and premises.

10. Reduce the spread of disease from a problem room to newer rooms by using steam to terminate a crop early.

11. Cover spawned compost with plastic.

12. Maintain an effective insect control program.

Sanitation

Non-porous surfaces, eg., plastics and metals, do not permit absorption of chemicals. However, wood, paper or sponge-like materials absorb the chemical-laden water and cannot be rinsed.

Table 3-1. Sanitation of non-porous and non-food contact surfaces

Chemical	Product	Rate in water	Comments
			Before using any sanitizer, remove gross filth and heavy soil deposits using a shovel, broom or vacuum. Clean the area with water and apply the solution, thoroughly wetting the surface.
ammonium chlorides	Verticide™	4 to 16mL/1 L	Treated surfaces should be wet for at least 10 minutes and left to air dry.
formaldehyde	Clean Crop Formalin Fungicide Solution	100mL/10 L	Rinse with potable water if equipment or tools are to be used right away.
sodium hypochlorite calcium hypochlorite		1000 ppm (ratio of product to water depends on product concentration)	Rinse with potable water if equipment or tools are to be used right away.
Do Not mix formaldehyde and sodium hypochlorite or calcium hypochlorite (chlorine). The mixture can form a potent carcinogen.			

Table 3-2. Between crops disinfection—Surfaces

Chemical	Product	Rate in water	Comments
ammonia chlorides	Verticide™	4 to 16mL/1 L	Apply solution, wetting the surface thoroughly. Treated surfaces should remain wet for at least 10 minutes and then air dried.
formaldehyde	Clean Crop Formalin Fungicide Solution	2–4 L/100 L	Heat the house to at least 18°C, then wash down all surfaces with the solution. Keep room closed for at least 24 hours after treating.
sodium hypochlorite calcium hypochlorite		1000 ppm (ratio of product to water depends on product concentration)	Apply solution, wetting the surface thoroughly. Rinse equipment or tools with potable water if they are to be used right away.
Do Not mix formaldehyde and sodium hypochlorite or calcium hypochlorite (chlorine). The mixture can form a potent carcinogen.			

Table 3-3. Between crops—Wood treatment

Chemical	Product	Rate in water	Comments
copper 8- quinolinolate	PQ–57	10 L in 100 L	Avoid high pressure mixing to reduce foaming. Apply to all wood surfaces in room, starting at lowest shelves. Use a low pressure sprayer. Allow to dry before filling with compost. Caution: PQ-57 is corrosive. Wear splash-proof goggles, rubber gloves and protective clothing. Avoid splashing and overflow of containers. Do not allow to run off to ground water, streams, ponds or lakes as it is toxic to fish.
propiconizole	Safetray P	600 mL in 100 L	Apply the spray solution with a large droplet sprayer to the wood surfaces. Ensure thorough coverage. Use about 20 L of spray solution per 100 m^2 of wood surface. The wood needs to dry before compost is added. Drying should occur in a sheltered, well-ventilated area.

Formalin-Chlorine danger

Any mixing of Formalin (formaldehyde) and chlorine (household bleach, sodium hypochlorite, calcium hypochlorite, etc) can result in the formation of a potent carcinogen (bis-chloromethyl ether). To avoid any possible danger, do not allow these chemicals to mix in either vapour or liquid form. Dispose of these materials in separate areas. Do not let them mix.

Bacterial diseases

Bacterial blotch
Pseudomonas fluorescens (biotype G)

Pale yellow areas or blotches occur, later developing to golden yellow, yellow-brown, or chocolate brown on the mushroom cap or stem. occasionally, the mushroom caps will have an overall dingy, off-colour appearance with a rapid deterioration and discolouration after harvest. Take care not to confuse this pathogen with verticillium disease. The Vineland Verticillium Medium (see *Appendix A – References on Insects and Diseases of Mushrooms* on page 30) can easily distinguish between the two.

Cultural management

Air temperature should not rise above compost temperature. If heating is required, provide only a small amount at any one time. Maintaining a stable difference between wet and dry bulb reading of 1 to 1.5°C will reduce significantly the occurrence of bacterial blotch. Do not water mushrooms less than 2 days before harvest. After watering, surface of mushrooms must be dried in 2–4 hours by increased ventilation. Blotch may also occur on crops where the compost moisture is below 64% at spawning. Careful compost moisture control during both phases of composting is necessary to avoid this cause of blotch.

Mummy disease
Pseudomonas spp.

The first symptom may be a delayed first flush. Mushrooms infected by the disease are characterized by curved stems with often distorted, tilted caps. At the base of the stem, the mycelium is stringy. The base of the stem is frequently swollen, with a fluffy growth of mycelium around it. When mushrooms are harvested, a large amount of casing adheres to the base of the stems. Affected mushrooms die and become dry. They are tough and leathery. The internal tissue will often show brown streaks or discolouration. When cut across the stem, there will be minute brown spots, or the cut face may be reddish-brown.

The disease spreads through infected mycelium, not by spores. Disease-affected crops will not produce subsequent breaks of harvestable mushrooms.

Cultural management

Where mummy disease is present, remove a 20-cm wide section of compost across the shelf and 1.5 m from either side of the visible infection. Treat the exposed netting and shelving thoroughly with formalin solution and cover the surface of the infected area with plastic. Clean up thoroughly and disinfect the production room before refilling to prevent reinfection. If plastic is used to cover the compost during spawn-run, remove it 2 days before casing to permit water on the compost surface to dry.

Fungal diseases

Dry Bubble
Verticillium fungicola

Early infection of the developing pin disrupts its growth into a ball-like mass, generally the size of a grape. Later contact on the stem causes it to shatter, with a slight tilting of the cap. Cap tissue turns brown, with a greyish hue in the infested area. Spots will develop within 48 hours on the cap when the pathogen infects a single site. The spots generally have a more indistinct margin than bacterial blotch and are less shiny.

Cultural management

Follow strict sanitation practices to prevent introducing the disease, including using clean or pasteurized casing medium and properly maintained air filtering system. Control fly populations. Dry bubble is kept in check on many farms by cropping for only three breaks. Careful use of the Vineland Verticillium Medium will help in detecting the weak link in the sanitation program or source of the infection.

Learn about the health hazards of the pesticide you are using.

Chemical management

Table 3-5. Application during casing and pre-production—Dry bubble, wet bubble, cob web and green moulds on page 26 and *Table 3-6. Application during production—Dry bubble, wet bubble, cob web and green moulds* on page 26.

Table 3-4. Application during Spawning—*Trichoderma* green mould

Chemical	Product	Rate	Comments
benomyl[1]	Benlate 50 WP	Mix 0.5 g with 22 g gypsum per 1 kg spawn	Completely mix the benomyl and gypsum before adding spawn to this mixture. Then, thoroughly coat the spawn with this blend.

1 Benlate 50 WP and Benlate Toss-N-Go will be illegal to use after September 30, 2003.

Table 3-5. Application during casing and pre-production—Dry bubble, wet bubble, cob web and green moulds

Chemical	Product	Rate	Comments
benomyl[1]	Benlate 50[2] WP, Benlate[2] Toss-n-Go	60 g in 140 L water/100 m^2 of production surface	Apply to the casing in the irrigation water. A second application may be made up to pinning. Do not apply within 2 days of harvest.
chlorothalonil	Bravo 500	254 mL/100 m^2 production surface 128 mL/100 m^2	Apply at casing or mix into the casing material. Apply at pinning. A minimum of 100 L of water per 100 m^2 is needed for good coverage of the casing. No more than 2 applications are permitted per crop. Mushrooms cannot be harvested within 7 days of application. Do not enter the treated area for 48 hours. Short-term tasks not involving hand labour may be performed if at least 4 hours have elapsed since application. The worker must wear long pants, long-sleeved shirt, hat and chemical-resistant gloves. Do not apply within 7 days of harvest.
formaldehyde	Clean Crop Formalin Fungicide Solution	20–25 L in 100 L water	Sprinkle the solution over the casing material while mixing, using 3.6 to 4.2 litres of solution for each cubic metre of casing material. Mix thoroughly and keep casing covered for at least 24 hours after treating. Air and casing material must be at least 18°C. All odour of formaldehyde must be gone before casing is applied to compost.
zineb[3]	Zineb 15 Dust King Mushroom Dust	60–125 g/100 m^2 production surface	Apply after casing and 3 times weekly before first break and then between breaks as required. Do not apply within 1 day of harvest.

1 *Verticillium* is generally resistant to benomyl. Repeated use (more than twice per crop) may increase *Verticillium's* tolerance to benomyl.
2 Benlate 50 WP and Benlate Toss-N-Go will be illegal to use after September 30, 2003.
3 Although zineb is allowed in Canada for use on mushrooms for domestic consumption, it may not be permitted by buyers of product for export.

Table 3-6. Application during production—Dry bubble, wet bubble, cob web and green moulds

Chemical	Product	Rate	Comments
formaldehyde	Clean Crop Formalin Fungicide Solution	430 mL/10 L water	Drench the diseased area with the solution. Four hours after treatment, remove mushrooms from the treated area and discard. No further production from treated areas can be expected.
zineb	Zineb 15 Dust King Mushroom Dust	60 -125 g/100 m^2 production surface	Apply after casing and 3 times weekly before first break and then between breaks as required. Do not apply within 24 hours of harvest.

Wet bubble
Mycogone perniciosa

The disease is best recognized by the large cauliflower-like distortion of the mushroom. This coral-like mass may measure up to 10 cm across. Dry bubbles from verticillium disease do not become this large. Under conditions of high humidity, amber to dark brown drops of liquid will develop on the white, fluffy surface.

The stem of a mature mushroom can be infected, showing a brown discolouration and eventual white, fluffy mycelial growth on the stem surfaces. The gills will be infected with white fluffy mycelium and the liquid drops may also appear.

Casing material contaminated with soil is the primary source of the pathogen.

Cultural management

Follow strict sanitation procedures.

Chemical management

See dry bubble *(Verticillium fungicola)* disease, *Table 3-5. Application during casing and pre-production—Dry bubble, wet bubble, cob web and green moulds* on page 26 and *Table 3-6. Application during production—Dry bubble, wet bubble, cob web and green moulds* on page 26.

Green mould
Trichoderma aggressivum (=Trichoderma harzianum), T. viride, T. koningii

The white mycelial growth will turn green on compost or casing as the spores are produced. *Trichoderma koningii* tends to sporulate late in the crop, towards third break, whereas *T. viride* will sporulate any time during the crop. The pathogen may attack the mushroom cap, showing a reddish-brown or purple-brown colour, possibly confused with bacterial blotch or *Verticillium* disease. Red pepper mites that feed on the spores and the mycelium of *Trichoderma* are a good indicator species for green mould.

The causal agent for green mould disease in North America is *Trichoderma aggressivum* [formerly *Trichoderma harzianum* (biotype Th4)]. This species is extremely destructive and is a fairly recent problem on Canadian farms. Its initial appearance is similar to the other green moulds. The green sporulation can be found in compost, casing or both. *Trichoderma harzianum* (biotype Th1; typical harzianum) is generally not a serious crop production problem.

Cultural management

In general, *Trichoderma* flourishes in compost as an indicator mould when excess carbohydrates are available, when the compost is not supplemented with sufficient nitrogen, or when supplements added at spawning are not mixed evenly. Adequate compost formulation and schedules prevent the problem. Supplements added at spawning should be evenly mixed throughout the compost.

Management of *T. aggressivum* depends on a thorough sanitation and hygiene program coupled with good insect and mite control. The early spawn-run period is the most vulnerable for infection and subsequent crop loss. Application of benomyl to spawn grain has been helpful in delaying disease expression (See *Table 3-4. Application during Spawning—Trichoderma green mould* on page 26). The use of non-grain spawn has also been beneficial in reducing infection. A casing infestation has little effect on the crop.

Some supplements can aggravate crop loss. Post-crop steam-off temperatures may not eradicate the organism. Green mould disease is easily moved about the farm on people crossing contact areas and on contaminated equipment and tools.

If you observe green mould, send samples to the University of Guelph Department of Plant Agriculture, Vineland campus, for identification. Check with research staff at Vineland for the most recent control strategies against *Trichoderma* disease.

Chemical management

See dry bubble (*Verticillium fungicola*) disease, *Table 3-5. Application during casing and pre-production— Dry bubble, wet bubble, cob web and green moulds* on page 26 and *Table 3-6. Application during production— Dry bubble, wet bubble, cob web and green moulds* on page 26.

Cobweb mould
Cladobotryum dendroides (=Dactylium dendroides)

Circular patches of white mycelium will attack mushrooms, covering them with a growth of coarse, white, aerial mycelium. Affected mushrooms turn brown and rot while the white mycelium may change to pink or red with age. The U.K. and Ireland have had significant problems from fungicide-resistant strains.

Cultural management
Good sanitation is essential. Disease is favoured above 18°C and at a relative humidity of less than 90%.

Pasteurize the casing material. The spores of this fungus are easily airborne. First, cover diseased areas with a damp paper towel and then cover the area with salt, etc.

Chemical management
See dry bubble *(Verticillium fungicola)* disease, *Table 3-5. Application during casing and pre-production—Dry bubble, wet bubble, cob web and green moulds* on page 26 and *Table 3-6. Application during production—Dry bubble, wet bubble, cob web and green moulds* on page 26.

Virus disease

La France disease
The symptoms of virus disease vary from a drop in yields to distorted mushrooms.

During the spawn-run period there is no visible expression. However, after the casing is applied, the more distinctive symptoms may show. The mycelium will have difficulty growing into the casing in some areas or will grow and then die back, leaving patches with no mushrooms. Mushrooms that do form may be normal, have small caps on normal size stems, have elongated stems that are slightly bent, die rapidly followed by a bacterial soft rot, open prematurely, be off-white, ashen, or tan, pin later than normal and frequently below the surface, turn brown rapidly when harvested, and be loosely attached to the casing.

The disease is transmitted through 2 known means: infected mycelium to uninfected mycelium through hyphal fusion (anastomosis) and infected spores germinating and the mycelium anastomosing with healthy mycelium.

Cultural management
Once the disease is established, it is impossible to control without completely sterilizing the production facilities, tools and all materials. If virus is diagnosed, heat the compost at 70°C for at least 12 hours.

You must do the following to prevent establishment of viruses:
- have high-efficiency filters in the fresh air system in all rooms
- discourage visits from other growers and visits to other mushroom farms where virus is suspect or known to be present
- avoid hiring workers who visit or do part-time work on a farm where virus is present
- and disinfect immediately any shipping bins returned to the farm.

Pick mushrooms before the veil opens to prevent liberation of spores that carry the virus. Cover spawned compost with plastic so that diseased spores cannot land on the surface. Between crops, routinely clean, disinfect and steam all shelving material and nets, which can harbour diseased mycelium.

A routine rotation of different mushroom strains in each production room may help prevent the establishment of virus disease.

Chemical management
None.

Weed moulds

Chaetomium olivaceum
(olive-green mould)

Coprinus fimetarius
(ink cap)

Sporendonema purpurascens
(lipstick mould)

Chromelosporium sp.
(cinnamon brown mould)

Papulaspora byssina
(brown plaster mould)

Scopulariopsis fimicola
(white plaster mould)

Trichoderma viride
(green mould)

Doratomyces stemonitis
(black whisker mould)

Cultural management
Good pasteurization and sanitation practices are always essential.

Lack of oxygen during the conditioning phase of indoor pasteurization promotes olive green mould.

Ink cap mould appears when compost contains excess ammonia or residual nitrogen compounds as a result of poor conditioning during Phase II.

Lipstick mould is reported to be associated with chicken manure in compost formula or wet compost, and occasionally where virus is present.

Cinnamon brown mould is an opportunistic fungus growing on casing that has been overly pasteurized, where strong formalin solution has been used, or where virus has killed the mycelium in the casing.

White and brown plaster moulds are stimulated by amines in the mushroom compost. Changes in composting practices (Phase I and Phase II) to improve compost quality will reduce the occurrence.

Both green mould and black whisker mould develop under conditions where compost has been under-composted, the carbon-to-nitrogen ratio is too high, or where the compost has overheated during the spawn-run period.

Chemical management
None.

Abnormalities — not diseases

During cultivation of the commercial mushroom, any of several abnormalities that are not caused by any living organism may appear. These conditions are described by some of the following names: stroma, rose comb, hardgill, open veil, weepers, hollow case, purple stem and saggy socks. Although these conditions are rare, they can disturb growers. Refer to *Appendix A – References on Insects and Diseases of Mushrooms* on page 30 for more information on these disorders.

APPENDIX A. References on Insects and Diseases of Mushrooms

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APPENDIX B. Ontario Ministry of Environment Pesticides Control Offices—Pesticide Officers

REGION/County	PESTICIDE OFFICER	Telephone/Fax
Central Region Toronto, Halton, Peel, York and Durham	Charles Zubovits/Cathy Wright 5775 Yonge St, 8th Floor Toronto, Ontario M2M 4J1	(416) 326-6700 1-800-810-8048 Fax (416) 325-6347
West-Central Region Haldimand-Norfolk, Niagara, Hamilton-Wentworth, Dufferin, Wellington, Waterloo, Brant	Charlie Roland 119 King St. West, 12th Floor Hamilton, Ontario L8P 4Y7	(905) 521-7640 1-800-668-4557 Fax (905) 521-7820
Eastern Region Frontenac, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville, Prescott & Russell, Stormont/Dundas & Glengarry Peterborough, Victoria, Northumberland, Renfrew, Ottawa-Carleton, Lanark, District of Nipissing (Townships of Airy, Murchison, Dickens, Lyell and Sabine)	Roberto Sacilotto 133 Dalton Avenue Kingston, Ontario K7L 4X6	(613) 549-4000 1-800-267-0974 (in Eastern Region only) Fax (613) 548-6908
Southwestern Region Elgin, Middlesex, Oxford, Essex, Kent, Lambton, Bruce, Grey, Huron, Perth, Simcoe	Gary Roberts 659 Exeter Rd., 2nd Floor London, ON N6E 1L3	(519) 873-5000 1-800-265-7672 Fax (519) 873-5020
Northern Region East Manitoulin, Nipissing, Parry Sound, Sudbury, Algoma East, Cochrane East, Haliburton, Muskoka	John Negusanti 199 Larch Street, Ste 1101 Sudbury, Ontario P3E 5P9	(705) 564-3249 Fax (705) 564-4180
Northern Region West Kenora, Rainy River, Thunder Bay, Algoma West, Cochrane West	Don Mitchell 435 James Street South, Ste. 331 Thunder Bay, Ontario P7E 6S7	(807) 475-1712 1-800-875-7772 Fax (807) 475-1754
Standards Development Branch	Pesticides Section 40 St. Clair Avenue West, 7th Floor Toronto, Ontario M4V 1M2	(416) 327-5519 Fax (416) 327-2936
Approvals Branch	Pesticides Licensing 2 St. Clair Avenue West, 12A Floor Toronto, Ontario M4V 1L5	(416) 314-8001 1-800-461-6290 Fax (416) 314-8452

APPENDIX C. The Metric System

Metric Units

Linear Measures (length)

10 millimetres (mm)	=	1 centimetre (cm)
100 centimetres (cm)	=	1 metre (m)
1,000 metres	=	1 kilometre (km)

Square Measures (area)

100 m x 100 m = 10,000 m^2 = 1 hectare (ha)

100 ha	=	1 square kilometre (km^2)

Cubic Measures (volume)

Dry Measure

1,000 cubic millimetres (mm^3)	=	1 cubic centimetre (cm^3)
1,000,000 cm^3	=	1 cubic metre (m^3)

Liquid Measure

1,000 millilitres (mL)	=	1 litre (L)
100 L	=	1 hectolitre (hL)

Weight-Volume Equivalents (for water)

(1.00 kg) 1,000 grams	=	1 litre (1.00 L)
(0.50 kg) 500 grams	=	500 mL (0.50 L)
(0.10 kg) 100 grams	=	100 mL (0.10 L)
(0.01 kg) 10 grams	=	10 mL (0.01 L)
(0.001 kg) 1 gram	=	1 mL (0.001 L)

Weight Measures

1,000 milligrams (mg)	=	1 gram (g)
1,000 grams	=	1 kilogram (kg)
1,000 kilograms	=	1 tonne (t)
1 mg/kg	=	1 part per million (ppm)

Dry-Liquid Equivalents

1 cm^3	=	1 mL
1 m^3	=	1,000 L

Application Rate Conversions

Metric to Imperial (approximate)

litres per hectare x 0.09	=	gallons per acre
litres per hectare x 0.36	=	quarts per acre
litres per hectare x 0.71	=	pints per acre
millilitres per hectare x 0.015	=	fluid ounces per acre
grams per hectare x 0.015	=	ounces per acre
kilograms per hectare x 0.89	=	pounds per acre
tonnes per hectare x 0.45	=	tons per acre

Imperial to Metric (approximate)

gallons per acre x 11.23	= litres per hectare (L/ha)
quarts per acre x 2.8	= litres per hectare (L/ha)
pints per acre x 1.4	= litres per hectare (L/ha)
fluid ounces per acre x 70	= millilitres per hectare (mL/ha)
tons per acre x 2.24	= tonnes per hectare (t/ha)
pounds per acre x 1.12	= kilograms per hectare (kg/ha)
ounces per acre x 70	= grams per hectare (g/ha)

Liquid Equivalents

litres/hectare		*gallons/acre (approx.)*
50	=	5
100	=	10
150	=	15
200	=	20
250	=	25
300	=	30

Dry Weight Equivalents

grams or kilograms/hectare		*ounces or pounds/acre*
100 grams	=	1 1/2 ounces
200 grams	=	3 ounces
300 grams	=	4 1/4 ounces
500 grams	=	7 ounces
700 grams	=	10 ounces
1.1 kilograms	=	1 pound
1.5 kilograms	=	1 1/4 pounds
2.0 kilograms	=	1 3/4 pounds
2.5 kilograms	=	2 1/4 pounds
3.25 kilograms	=	3 pounds
4.0 kilograms	=	3 1/2 pounds
5.0 kilograms	=	4 1/2 pounds
6.0 kilograms	=	5 1/4 pounds
7.5 kilograms	=	6 3/4 pounds
9.0 kilograms	=	8 pounds
11.0 kilograms	=	10 pounds
13.0 kilograms	=	11 1/2 pounds
15.0 kilograms	=	13 1/2 pounds

Metric Conversions

5 mL	=	1 tsp
15 mL	=	1 tbsp
28.5 mL	=	1 fl. oz

Conversion Tables — Metric to Imperial

Length

1 millimetre (mm)	=	0.04 inch
1 centimetre (cm)	=	0.40 inch
1 metre (m)	=	39.40 inches
1 metre (m)	=	3.28 feet
1 metre (m)	=	1.09 yards
1 kilometre (km)	=	0.62 mile

Area

1 square centimetre (cm^2)	=	0.16 square inch
1 square metre (m^2)	=	10.77 square feet
1 square metre (m^2)	=	1.20 square yards
1 kilometre (km^2)	=	0.39 square mile
1 hectare (ha)	=	107.636 square feet
1 hecture (ha)	=	2.5 acres

Volume (dry)

1 cubic centimetre (cm^3)	=	0.061 cubic inch
1 cubic metre (m^3)	=	1.31 cubic yards
1 cubic metre (m^3)	=	35.31 cubic feet
1,000 cubic metres (m^3)	=	0.81 acre-foot
1 hectolitre (hL)	=	2.8 bushels

Volume (liquid)

1 millimetre (mL)	=	0.035 fluid ounce
1 litre (L)	=	1.76 pints
1 litre (L)	=	0.88 quart
1 litre (L)	=	0.22 gallon (Imp.)
1 litre (L)	=	0.26 gallon (U.S.)

Weight

1 gram (g)	=	0.035 ounce
1 kilogram (kg)	=	2.21 pounds
1 tonne (t)	=	1.10 short tons
1 tonne (t)	=	2,205 pounds

Pressure

1 kilopascal (kPa)	=	0.15 pounds/in^2

Speed

1 metre per second	=	3.28 feet per second
1 metre per second	=	2.24 miles per hour
1 kilometre per hour	=	0.62 mile per hour

Temperature

°F = (°C X 9/5) + 32

Imperial to Metric (approximate)

Length

1 inch	=	2.54 cm
1 foot	=	0.30 m
1 yard	=	0.91 m
1 mile	=	1.61 km

Area

1 square foot	=	0.09 m^2
1 square yard	=	0.84 m^2
1 acre	=	0.40 ha

Volume (dry)

1 cubic yard	=	0.76 m^3
1 bushel	=	36.37 L

Volume (liquid)

1 fluid ounce (Imp.)	=	28.41 mL
1 pint (Imp.)	=	0.57 L
1 gallon (Imp.)	=	4.55 L
1 gallon (U.S.)	=	3.79 L

Weight

1 ounce	=	28.35 g
1 pound	=	453.6 g
1 ton	=	0.91 tonne

Pressure

1 pound per square inch = 6.90 kPa

Temperature

°C = (°F – 32) X 5/9

Emergency and First-Aid Procedures for Pesticide Poisoning

For a major spill, a theft or a fire involving a pesticide call the Ministry of the Environment at **1-800-268-6060.**

For pesticide poisonings and pesticide injuries call the Poison Information Centre:

Toronto	1-800-268-9017
Ottawa (Bilingual)	1-800-267-1373
Hearing Assistance (TTY)	1-877-750-2233

PREVENT ACCIDENTS

- **Read the label.** Follow all the precautions the label recommends. Read the First Aid section of the label BEFORE you begin to handle any pesticide.
- **Make sure that someone knows** what pesticides you are working with and where you are.
- **Keep a file of labels and product Material Safety Data Sheets (MSDS) for the pesticides you use.** Make sure everyone knows where to find this in case of an emergency.
- **Post emergency numbers near all telephones.**
- **Keep clean water, paper towels, extra gloves and clean coveralls close by** in case you spill pesticide on yourself.

If someone has been working with pesticides and you see any possible symptoms of pesticide poisoning or injury, take emergency action immediately.

IF AN ACCIDENT OR POISONING HAPPENS

- Protect yourself from injury first.
- Stop the exposure to the pesticide. Move the victim away from the contaminated area.
- Check the 4 basic facts — identify the pesticide, the quantity, the route of entry and time of exposure.
- Call an ambulance or the Poison Information Centre.
- Start first aid. This is not a substitute for professional medical help.
- **Provide the label, MSDS sheet or container to emergency personnel** at the scene — or take it with you to the hospital. Do not transport pesticide containers in the passenger compartment of the vehicle.

Cette publication hautement spécialisée n'est disponible qu'en anglais en vertu du règlement 411/97, qui en exempte l'application de la *Loi sur les services en français*. Pour obtenir de l'aide en français, veuillez communiquer avec le ministère de l'Agriculture et de l'Alimentation au numéro 1 877 424-1300.

FIRST AID

If a pesticide comes in contact with skin:

- remove all contaminated clothing; wash skin thoroughly with lots of soap and warm water
- dry skin well and cover with clean clothing or other clean material.

If pesticide comes in contact with eyes:

- hold eyelids open wash the eyes with clean running water for 15 minutes or more.

If pesticide was inhaled:

- move the victim to fresh air and loosen tight clothing
- give artificial respiration if the victim is not breathing.

Do not breathe in the exhaled air from the victim — you could also be poisoned.

If a pesticide was swallowed:

- **call the Poison Information Centre IMMEDIATELY.**

Emergency numbers are listed at the front of each Bell telephone directory.

For information, or to obtain copies of this or any other ministry publication please:
call 1-888-466-2372 from within Ontario, (519) 826-3700 from outside the province or OMAF's TTY line at (519) 826-7402 for the hearing impaired, email your request to *products@omaf.gov.on.ca*, or visit OMAF's Web site at *www.gov.on.ca/omaf*.

A complete list of all OMAF products and services, and order forms, are available on the Web site. Orders can be faxed to (519) 826-3633 or mailed to Government Information Centre, OMAF, 1 Stone Road West, Guelph, Ontario N1G 4Y2.

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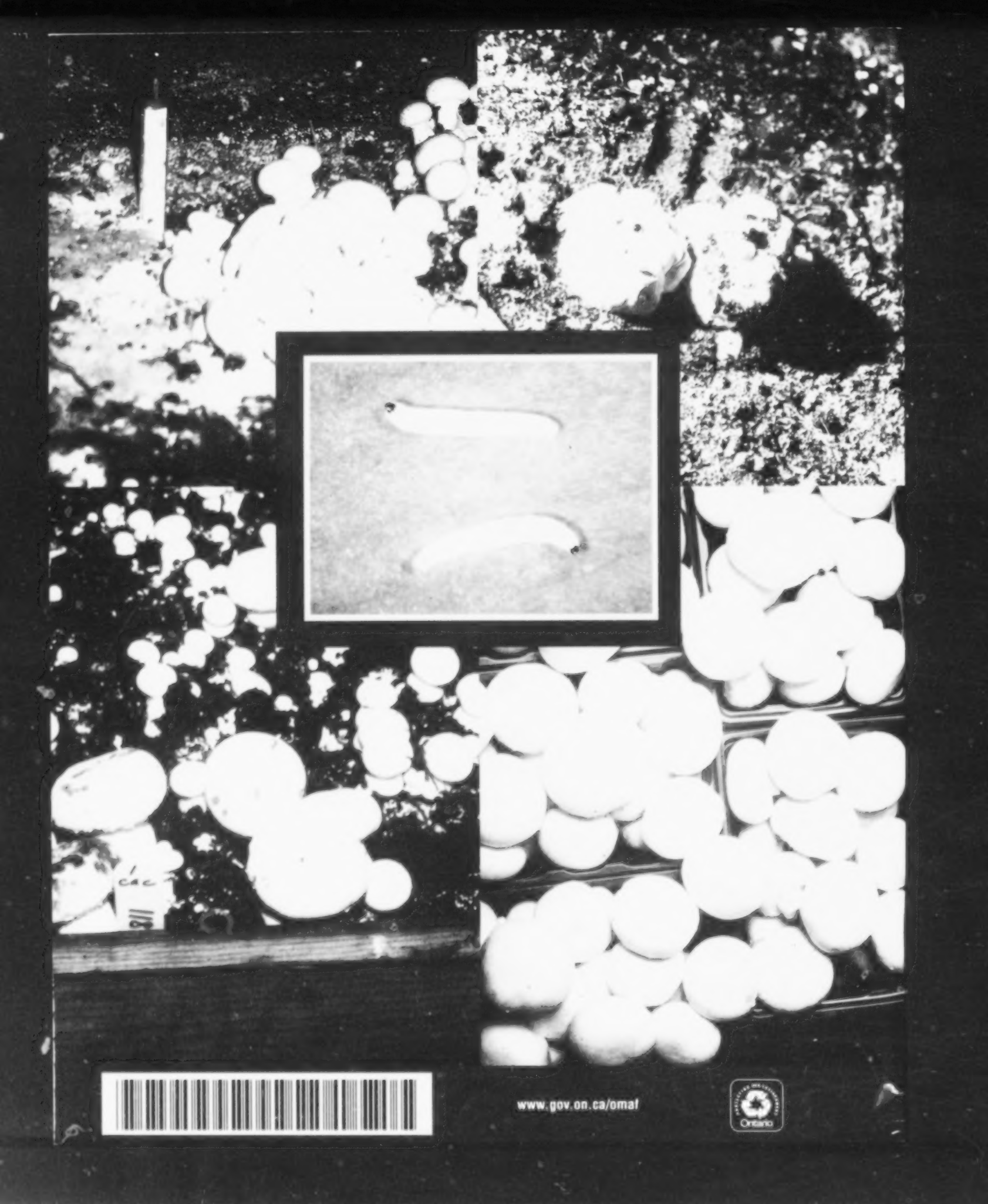

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